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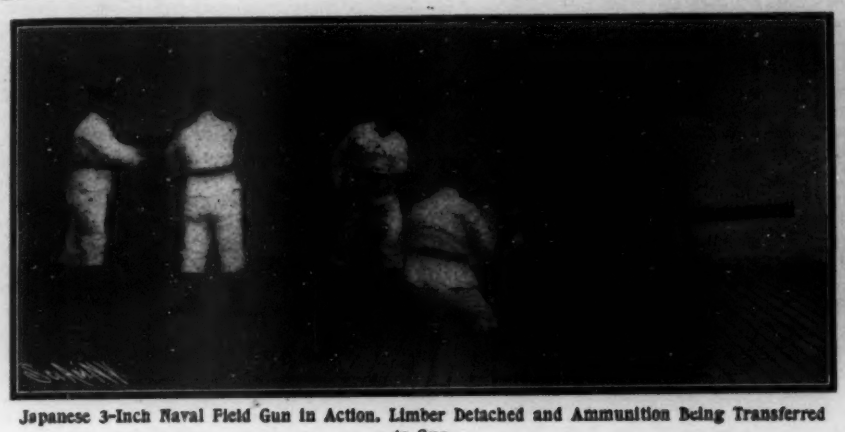
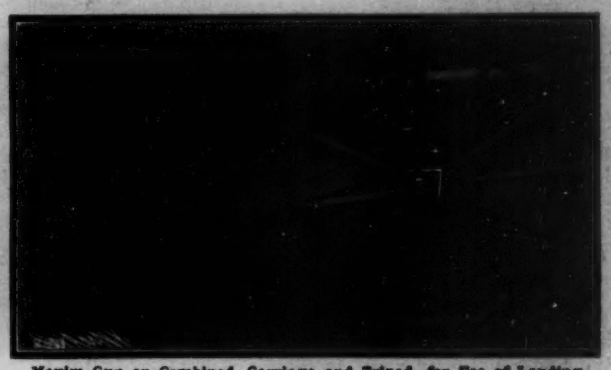
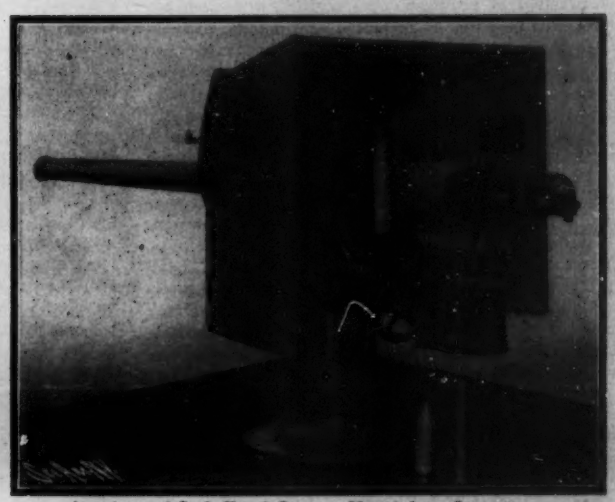


Japanese 3-Inch Naval Field Gun in Action. Limber Detached and Ammunition Being Transferred to Gun.

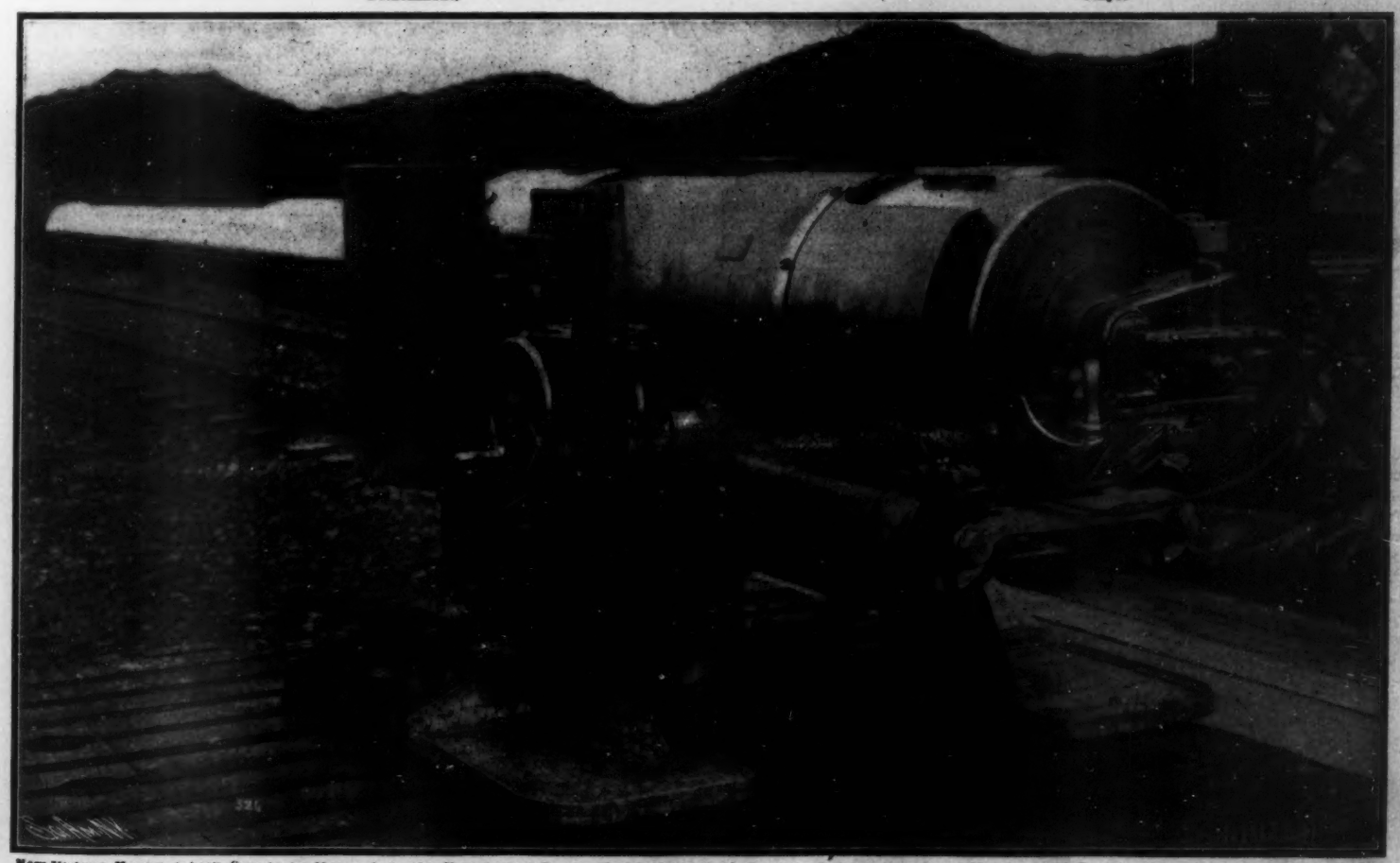


Maxim Gun on Combined Carriage and Tripod, for Use of Landing Parties.

Three-Inch Rapid-Fire Gun with Limber Attached, Showing Method of Hauling by Gun Detachment.



Armstrong 3-Inch Naval Gun, as Mounted on Japanese Ships.



New Vickers-Maxim 6-inch Gun to be Mounted on the New 16,000-Ton Battleship Recently Ordered by Japan. Velocity at Muzzle, 3,000 Foot-Seconds; Energy, 6,240 Foot-Tons.

THE GUNS OF THE JAPANESE NAVY.—[See page 11.]

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NEW YORK, SATURDAY, JULY 2, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SUPERHEATED STEAM.

Every engineer knows that the improvement in steam-engine economy witnessed during the last thirty years has been due primarily to the constantly increasing higher steam pressures employed and to the introduction of compound and multiple-expansion engines. To be sure, many mechanical details, such as valve gears and governors, have been perfected; but the fact remains that whatever progress has been made is due to the utilization of higher pressures. That improvement, it must be admitted, has probably reached its limit. Such is the increased cost of building more than a triple or quadruple engine, that the very slight increase in economy produced by an additional cylinder hardly proves remunerative. Moreover, certain limitations have been imposed by boiler design, limitations which have prevented the attainment of pressures greater than 250 pounds.

It is because the present system of steam engineering is incapable of any great advancement that we may expect a more general return to the use of the superheater. We use the word "return" advisedly; for, whatever may be the general impression among engineers, the employment of superheated steam dates back very nearly three-quarters of a century. As far back as 1828 a certain Capt. McGregor, in order to compete with the record established by a rival Cornish engine, whose cylinders had been insulated with sawdust, constructed a jacket of brick around the cylinder of his engine and the steam pipe, with an air space between the brickwork and the iron. In the open space he built a fire; and by the heat generated he increased the duty of his engine from 41,000,000 to 63,000,000 foot-pounds per bushel (86 pounds) of coal. The great Richard Trevethick himself made many an interesting experiment, which convincingly proved, to him at least, the great reduction in coal consumption to be effected by the utilization of superheated steam. Every great engineer has, at some time, conducted experiments of more or less value. Men of the stamp of Ericsson, Hirn, Isherwood, and Faraday were able to show an increase in economy varying from 20 to 27 per cent. Such, indeed, was the impetus given by their researches that superheated steam was very widely introduced in marine engineering in the two decades extending from 1850 to 1870, and this, notwithstanding the great difficulties encountered in lubrication, and notwithstanding the fact that the material of which the superheaters were made was unable to withstand intense heat for any length of time. The lubricant of those early days consisted, not of our present mineral oils, but of animal fats, which obviously were anything but commendable lubricating agents. But even animal oils proved of sufficient service with the low pressure of 50 pounds and the temperature of 100 deg. Fah. given to the superheated steam of that day. It was when the high-pressure, compound engine was introduced, that the development of the superheater was checked. The greater economy of the new engine, compared with the low-pressure, single-expansion machines that had been theretofore used, the consequent saving of space and weight, both of them important on shipboard, and the reduction of the temperature in superheating the steam to a point at which the difficulties of lubrication were overcome—all these contributed to the abandonment of the old-time low-pressure, superheated steam engine.

Ever since the days of James Watt, engineers have realized that the principal loss of efficiency in the steam engine is due to the condensation of steam in the cylinders. Assuredly, the most obvious way of overcoming the difficulty is to superheat the steam. This, moreover, would be one of the simplest methods of increasing the economy of the steam engine, still lamentably low, despite the progress of recent years. To those who are at all familiar with the history of steam engineering in the past century, may be commended a paper by Prof. Storm Bull, recently read before the Western Society of Engineers, and published in the current issue of the SUPPLEMENT, in which the subject is discussed with a fullness that cannot here be emulated.

It is rather remarkable that the improvement of the superheated steam engine has been undertaken chiefly in Germany. Many readers will doubtless recall the astonishing results obtained about nine years ago by Schmidt with a boiler and engine of his own design—results which showed that with superheated steam a consumption of steam of only 10.4 pounds per indicated horse-power was possible, and that the amount of coal used per indicated horse-power per hour could be reduced to 1.3 pounds. Schroeter has lately published results of equally interesting tests of a 250-horse-power steam engine. The difficulties which were encountered many years ago in the construction of superheaters that would not readily wear out have in a large measure been overcome. The problem of lubrication has also been solved with the introduction of suitable mineral oils. With these technical advancements, therefore, the outlook for the superheated steam engine is certainly bright.

STATE REGISTRATION OF UNITED STATES TRADE MARKS.

The status of the trade marks which have been registered in the United States Patent Office is indeed peculiar, for under the decision of the United States Supreme Court, which was rendered in the case of Warner vs. Searle & Hereth Company (195 U. S. 191), decided November 30, 1903, many registrations fail to afford the protection which, when filing their applications for registration, the registrants desired.

The authority of Congress to pass laws governing trade marks, and the right to their registration, as well as its authority to legislate on all other questions, is derived from the Constitution; and only when a law is founded on some provision of the Constitution which expressly authorizes, or by way of implication gives power to carry into efficient operation those powers expressly given, is the law constitutional. In all other cases, the law is unconstitutional and of no effect. Examining the Constitution, provisions can be found under which Congress is in certain cases authorized to enact laws for the registration and the protection of trade marks; but Congress is not authorized to register all trade marks, which are used in trade in the United States, and any general law for the registration of trade marks, which are the property of citizens of the United States and citizens and subjects of other nations, would, of course, be invalid. The early national trade mark law of the United States attempted to authorize the registration in the Patent Office of all trade marks by their lawful owners, and, as it exceeded the authority vested in Congress, it was declared unconstitutional in the trade mark cases, 100 U. S. 82, which were decided on November 18, 1879.

In that case, Justice Miller carefully considered the constitutional provisions and the trade mark laws passed by Congress, and, in his opinion, he stated that of the two provisions of the Constitution under which counsel claimed that Congress was authorized to enact general laws for the registration of trade marks, the first was the clause which authorized Congress to enact laws "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their writings and discoveries;" and the second clause was that which, in connection with the granting clause, is as follows: "The Congress shall have power to regulate commerce with foreign nations, and among the several States, and with the Indian tribes." The first clause was held not to refer to trade marks, for neither originality, invention, discovery, science, nor art is in any way essential to a trade mark, nor was it made so under the laws for their registration. Considering the second clause, the Justice stated that "while commerce with foreign nations means commerce between citizens of the United States and citizens and subjects of foreign nations, and commerce among the States means commerce between individual citizens of different States, there still remains a very large amount of commerce, perhaps the largest, which, being trade or traffic between citizens of the same State, is beyond the control of Congress." As the law did not attempt to limit the right to registration to those cases when the applicant had a foreign trade or a trade with citizens of another State or with an Indian tribe, Congress exceeded the authority vested by the Constitution, and the laws were invalid.

Having before it the decision of Justice Miller, Congress enacted in 1881 another law for the protection of trade marks, which law is now in force, but because of the decision in the case of Warner vs. Searle & Hereth Company, it is not of the value which Congress intended to give it. The law of 1881, unlike the old law, authorizes the registration of trade marks in the Patent Office, only in cases where the applicant uses his trade mark in commerce with foreign nations or with the Indian tribes, and it therefore comes within the express terms of the Constitution, and the validity of the statute has not by the courts been questioned. The difficulty arises because of the construction which is given to the statute. In his decision construing the statute, the Justice states that as the law of 1881 was enacted to avoid the unconstitutional features of the old law, and as it expressly limited the right of registration to those marks which were used in commerce with foreign nations or with the Indian tribes, he held that a trade mark registration under the provisions of the law was not infringed unless the defendant injured the registrant's trade because of his use of the mark while engaged in foreign commerce or in trade with the Indian tribes. When the person copying the registered trade mark does not engage in commerce with a foreign country or with an Indian tribe, he cannot be held to have infringed the registered trade mark; for otherwise it would be possible for a registrant to secure the privileges which Congress previously attempted to confer under the general law, and which it was held that under the Constitution could not be done. It is therefore impossible for the owner of a trade mark to prevent, under the United States registration statute, its infringement, when the infringer is doing business in only one State, for Congress cannot enact a law protecting a trade mark in such a case; and where the infringer uses the mark in commerce between the States, the infringement cannot be prevented under the national registration laws now in force, for they do not provide for the protection of trade marks in interstate commerce, although the Constitution authorizes Congress to enact laws for the registration and protection of trade marks, which are used in commerce between the States. It is expected that Congress, at its next session, will amend the federal trade mark statutes, and, among other changes, there will undoubtedly be found one which will provide for the registration of trade marks, which are used in commerce between the States. Until that amendment is made, and in all cases where the proprietor of a mark wishes to be sure that his trade mark is protected, by all the provisions of the law, against infringement by persons engaged in business in only one State, it is advisable to comply with the trade mark registration laws which have been enacted by the legislators of many of the States.

While the protection afforded by a United States registration has been, by the decision referred to, limited, it is nevertheless important for manufacturers to secure the registration under the federal laws, for the Patent Office is an office of record, to which persons all over the world refer for evidence of the ownership of trade marks in the United States. The rights of seizure under the United States statutes and the remedies afforded for the infringement of marks are also of considerable value where the infringer is engaged in foreign trade.

When the proprietor of the trade mark and the infringer are citizens of different States, the federal courts have in many cases jurisdiction, independent of the Patent Office registration, but the rights of the parties are then founded on the common law, and not on the statutory registration.

ON THE STATE OF THE CARBON VAPORIZED IN GLOW LAMPS.

Glow lamp filaments, as is known, are composed chiefly of amorphous carbon, by calcination of a vegetable fiber, which, on being brought to a white heat in the vacuum by the electric current, will yield a trace of carbon vapor, the condensation of which on the walls of the bulb in most cases results in lining the glass with a brown coating producing a gradual darkening of the lamp.

In a paper recently read before the French Academy of Sciences, Prof. Berthelot examines the state of this vaporized carbon at the lowest possible temperatures, comparing it with such well-known allotropic modifications of carbon as the diamond, graphite, amorphous carbon. The main results of this investigation are the following:

Carbon gives off an appreciable vapor tension at a temperature not exceeding 1,500 deg. C.; this tension being so low as to require several hundreds of hours to produce some milligrammes of condensed carbon, even in the nearly absolute vacuum of electric lamps. On the other hand, the carbon thus vaporized *at the lowest possible temperatures*, is, under Prof. Berthelot's experimental conditions, amorphous carbon without any addition of graphite or diamond. The temperature at which a vapor tension of carbon may be noted proves thus about 2,000 deg. below the boiling point, which, according to Prof. Violle, is 3,600 deg.; this interval is very much larger than the interval of temperatures during which most of the remaining bodies exhibit an appreciable vapor tension. This tension, however, in the case of carbon, does not, in Berthelot's opinion, correspond with a simple vapor-

ization, occurring without any intimate change in the chemical constitution of the body. Though representing the same chemical element, carbon assumes in the solid state a multitude of different conditions, exhibiting rather different physical and chemical properties. There seems to be a series of progressive condensations, the limits of which would correspond with the different modifications of carbon.

According to ordinary analogies, the physical properties of composite bodies, capable of being formed directly, are a consequence of those of their components, except that they are more or less modified on account of the loss in energy resulting by reason of this combination. The combination of hydrogen, boiling at —252 deg., and that of oxygen, boiling at —182 deg. C., will thus give water, which boils at +100 deg. C. The energy which maintains at the gaseous state the free molecules of hydrogen and oxygen, has thus decreased to an enormous extent, as corresponding with the 59,000 calories lost at the instant of their combination, with the formation of a molecule of gaseous water. The same seems to be true of carbon in its combinations with hydrogen. The real existence of this element in an identical gaseous state, no matter what may be the origin, is shown by spectrum analysis, both in the electric arc and in the sparks through its oxides, hydrides, etc., as well as in the flames produced by the combustion of these different compounds.

Taking into account the boiling points of acetylene and the gaseous carbides of hydrogen, as well as of the gaseous oxides, etc., of carbon and the analogy above stated, the normal condition of carbon at the ordinary temperature should be that of a permanent gas, the boiling point of which would be comprised between those of hydrogen and oxygen. A similar gas, however, would nearly instantaneously be transformed into polymerics by the reciprocal combination of its molecules, this change occurring with considerable amounts of heat given off.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

Nothing of much general interest has occurred in the astronomical world during the past month. The journals of the science have been full of the ordinary routine observations of planets, comets, variable stars, and the like, with occasional bits of mathematical theory; but there has been little or nothing of interest to those who are not specialists.

All that need be recorded here is that further observations of Brooks' comet show that its orbit is nearly parabolic, and that its period of revolution must be long, if, indeed, it ever returns at all. The calculated orbit of short period to which we referred last month, turns out to have been affected by a rather large error in one of the observations on which it was based, in the way which was explained at the time. There remains nothing remarkable about the comet except its great perihelion distance—over 250,000,000 miles. It is rarely that a comet is observed at such a distance from the sun, and this one, though telescopically inconspicuous, must really be a pretty big comet to be seen at all so far away.

A question has recently been raised by a correspondent whose answer may be of enough interest to warrant our spending a few moments on it. He asks: "Why do you refer to the Great Bear as feminine?"

We must go back into the age of classical mythology for the reason. Even then we do not reach the first historic recognition of this noble constellation. It was known to the Egyptians, who called it the Hippopotamus! We need hardly regret that this designation has become obsolete. The people of southern Europe saw in the same stars the more familiar figure of a bear, and the legends which grew up around it were finally given a permanent shape by Ovid in his "Metamorphoses." As he tells the story, Callisto, an Arcadian nymph, was beloved by Jupiter. Juno, in fierce anger, turned her into a bear, depriving her of speech that she might not appeal to Jupiter. Her son, Arcas, while hunting, came upon her, and failing to recognize her in her metamorphosed form, raised his bow to shoot her. Jupiter, moved by pity, prevented the matricide by transforming the son also into a bear, and took them both up to the heavens, where they were placed among the constellations, and Neptune granted them the special favor that they should not be obliged to set and pass into his domain, as the sun and planets did. The constellation has had still other names, and been represented by other figures, notably the very ancient one of the Plough or the Wain, in which the four stars of the quadrilateral are the wheels of a wagon, and the other three are the horses. Our own common name—the Dipper—appears to be an American invention—at least it is so regarded in England. It is certainly realistic, but it does show some evidence of modern date—certainly later than the invention of tinware. But Ovid has undoubtedly fixed the permanent designation of this group of stars, and from his story there can be no doubt that Ursa Major is really a she-bear, while Ursa Minor is masculine. Both the Bears have very long tails, as anyone may see for himself.

Admiral Smyth, in his "Cycle of Celestial Objects," quotes an explanation given by a Cambridge astronomer in 1590, which deserves to be given *verbatim*.

"Scholar.—I marvell why (seeing she hath the forme of a beare) her taile should be so long.

"Master.—I imagine that Jupiter, fearing to come too nigh unto her teeth, layde holde on her tayle, and thereby drewe her up into the heaven; so that shee of herself being very weightie, and the distance from the earth to the heavens very great, there was great likelihood that her taile must stretch. Other reason know I none."

THE HEAVENS.

If we go out at nine o'clock on a clear evening in the middle of July, and look due south, the most prominent constellation will be Scorpio. Its brightest star, Antares, is fiery red—one of the reddest stars in the sky. A smaller star flanks it on each side, and three fairly bright ones form a vertical line on the right. These are in the Scorpion's claws, while his tail may be followed below Antares down to the southern horizon, where it curves back, and ends in a conspicuous group of stars which mark the sting. To the left is Sagittarius with the little Milk Dipper, and beyond is Capricornus, into which Saturn is just rising.

The bright star in the Milky Way above Scorpio is Altair, and the one of almost equal brilliance, much farther north, is Alpha Cygni; while Vega, which lies just to the west of the galaxy, surpasses them both.

The great square of Pegasus is the only prominent group in the east. On the meridian are Draco (above the pole), then Hercules, and next Ophiuchus, above Scorpio. West of Hercules are Corona and Boötes. The latter constellation contains Arcturus, the brightest star now visible. Virgo lies south and west of Boötes, and Leo west of it, close to the horizon. Ursa Major is high in the northwest, and Casseopeia and Cepheus are lower down in the northeast.

THE PLANETS.

Mercury, Venus, and Mars are invisible during the month, being too near the sun. The first two are evening stars in the early part of July, but soon pass through inferior conjunction—Venus on the 8th and Mercury on the 9th—and become morning stars. Mars is morning star, but is still too near the sun to be seen, though he may perhaps be picked up at the end of the month, when he rises an hour before sunrise.

Jupiter is morning star in Pisces, and is the most conspicuous object in the morning sky. On the 21st he is in quadrature with the sun, and comes to the meridian at 6 A. M.

Saturn is in Capricornus and will soon be prominent in the evening sky. He is due south at 2 A. M. in the middle of the month and more than an hour earlier at its close.

Uranus is in Sagittarius, and is well placed for evening observation. On the 15th he is in R. A. 17h. 46m., dec. 23 deg. 37 min. south, and comes to the meridian at 10.15 P. M. He is not near any conspicuous star, but he can easily be identified if one has a good star map.

Neptune is in Gemini, too near the sun to be observed.

THE MOON.

Last quarter occurs at 6 P. M. on the 5th, new moon at midnight on the 12th, first quarter at 3 P. M. on the 19th, and full moon at 4 A. M. on the 27th. The moon is nearest us on the 14th, and farthest away on the 2d, and again on the 30th. She is in conjunction with Saturn on the 1st, Jupiter on the 6th, Neptune on the 11th, Mars on the 12th, Mercury and Venus on the 13th, Uranus on the 26th, and Saturn again on the 28th.

Cambridge Observatory, England.

THE PURCHASE OF A RESERVOIR SITE.

Another step has been taken toward the transformation of the arid West. The Secretary of the Interior has authorized the purchase of the Hondo reservoir site in New Mexico for the sum of $20,000. It is in Chaves County, about 12 miles west of Roswell.

The site of this proposed reservoir is a natural depression, which, with a small amount of embankment, can be given a capacity of 40,000 acre-feet. This will hold practically all the water that the Hondo will furnish during low-water years. It is proposed to store here the flood waters of this stream and draw on them through lateral canals for irrigating the lands below the reservoir.

The lands that will be benefited by the reservoir waters are naturally fertile and may be easily irrigated at slight expense. They are free from alkali and will be ultimately worth at least $100 an acre when planted to alfalfa and corn. If used for fruit growing, to which they are specially adapted, they may have a far greater value.

No engineering difficulties are expected in the work. The natural reservoir will have to be enlarged and canals built for the inlet and outlet of the waters. It is estimated that the cost of constructing the reservoir and bringing the water to the arid lands will approximate $240,000, or $20 an acre for a minimum acreage of 12,000. It is believed, however, that nearly 15,000 acres will be served.

SCIENCE NOTES.

The oldest working clock in Great Britain is that of Peterborough Cathedral, which dates from 1320, and is conceded to have been made by a monastic clockmaker. It is the only one now known that is wound up over an old wooden wheel. This is some 12 feet in circumference, carrying a galvanized cable about 300 feet in length, with a leaden weight of 3 hundredweight. The cable has to be wound up daily. The gong is the great tenor bell of the cathedral, which weighs 32 hundredweight, and it is struck hourly by an 80-pound hammer. The going and the striking parts of the clock are some yards apart, communication being by a slender wire. The clock is not fitted with a dial, but the time is indicated on the main wheel of the escapement, which goes round once in two hours. This clock is of most primitive design, more so than the famous one made for Charles V. of France by Henry de Nick.

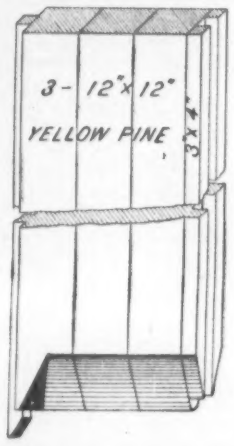
According to the report of M. R. Gallerand, a French scientist, the Sakalaves of Madagascar use the pith of a certain palm tree as an article of food. The tree is found in the Ambongo region and is known as the *satranabe*. According to Pernir, it is the *Medemia nobilis*, nearly related to the *Hyphæne*. In that region the *satranabe* covers vast spaces either along the seacoast or bordering the rivers. After cutting down the tree, the natives take out the pith, which runs from 4 to 10 pounds per tree, then dry, powder and sift it, thus forming a kind of flour. Some of this flour was sent to Marseilles to be analyzed at the Industrial Laboratory. It is a fine yellow powder and when fresh has a somewhat sweetish taste, which it had lost, however, upon arriving, and its solution did not act upon a beam of polarized light. When shaken up with water, the flour swells up and a light yellow liquid is obtained which has the odor of beer. About 17 per cent of the matter is dissolved. When fresh the product contains 13.3 per cent of water. After drying to expel all the water, it anayizes as follows: Starch, 66.833 per cent; cellulose, 12.939; albuminoid matter, 10.538; fatty matter, 1.037; mineral salts, 8.2 per cent. Among the salts are sulphate of potash, chloride of sodium, phosphate of lime, magnesia, oxide of iron; silica is also found. What is to be remarked principally about this product is the relatively large proportion of albuminoid matter it contains. In this respect it ranks ahead of the potato, manioc, and sweet potato, seeing that the latter contain 6.23, 3.30, and 3.38 per cent of nitrogen substances.

Some highly interesting and valuable archeological discoveries have been made on the site of the ancient Greek city Olbia. The site is situated on the southern bank of the Boug, about midway between Otchakoff and Nicolaieff, and not far distant from the estuary of the Dnieper. This ancient city was a colony of Miletus 655 B. C., and was a great center for Greek trade with the interior. It is generally maintained among archeological authorities that a trade route extended from Olbia across country to the northern sea, and when a find of ancient Greek coins was made, it was contended to be substantial proof of the fact. Recently, however, it was proved that these coins were spurious. Olbia was destroyed by the Getæ about 70 to 60 B. C., but it revived, and when it was visited by Dion Chrysostum about 100 A. D., it was again a flourishing city. The excavations that are now in progress upon the site of this city are being carried out by M. Formakovski under the auspices of the Russian Archeological Society. Mr. Formakovski has succeeded in unearthing extensive portions of the walls and foundations of the original city, which date back from the seventh century B. C. The masonry is identical with that of the ruins of ancient cities excavated in various parts of Greece. Before this depth was reached, two different strata of walls and basements bearing descriptions of the fourth and first centuries B. C. were encountered. The stone blocks composing the ruins of houses, temples, etc., in these upper strata are of remarkably exact area, square proportions, and excellently dressed. The more solid constructive work is, however, found in the remains of the original city. At this depth there was unearthed a perfectly preserved wine cellar. Some fifty huge jars or vases had evidently contained red wine, now turned to a light powdery substance. A large collection of valuable antiques in gold, marble, and ancient pottery has also been found in these newly-uncovered ruins. These have been dispatched to the Hermitage at St. Petersburg. M. Formakovski, however, is carefully examining every antique unearthed, to establish its genuine character, as it was on this site that the spurious tiara of Saitapharnes, now in the Louvre, was alleged to have been discovered.

THE RAPID TRANSIT SUBWAY TUNNEL UNDER THE HARLEM RIVER.

In our issue of October 31, 1903, we described the novel method of construction used in building the Rapid Transit Subway tunnel under the Harlem River. This tunnel construction, it will be recalled, was invented by Mr. D. D. McBean, one of the contractors for that section of the Subway, to meet the difficult requirements of building the tunnel through the soft mud just below the surface of the river bottom. In order to prevent obstruction to the navigation of the river, it was required that the tunnel be built in two sections. Experience gained in the construction of the first half of the tunnel led to the development of important improvements which are now being successfully employed in the building of the second half. The original plan was to dredge out a channel in the mud along the line of the tunnel, drive two walls of sheet piling along this line and across the ends of the tunnel section and then to sink and bolt onto the sheet piling a heavy timber roof, thus forming a caisson within which, under a suitable pneumatic pressure, the workmen could construct the tunnel proper. In the improved method the same process is followed, except that the sheet piling is cut off on the spring line of the tunnel and the upper half of the tunnel, which is assembled in a pontoon at the surface of the river, is lowered and permanently secured to this sheet piling in place of the timber roof. Fully one-half of the work is thus done above water, and the remainder of the work, namely, that of forming the lower half of the tunnel, is done under a comparatively low pneumatic pressure. Considerable saving is effected in the amount of timber used, since the sheet piling is cut off twelve feet lower down than in the first half of the tunnel, and the timber roof is entirely dispensed with.

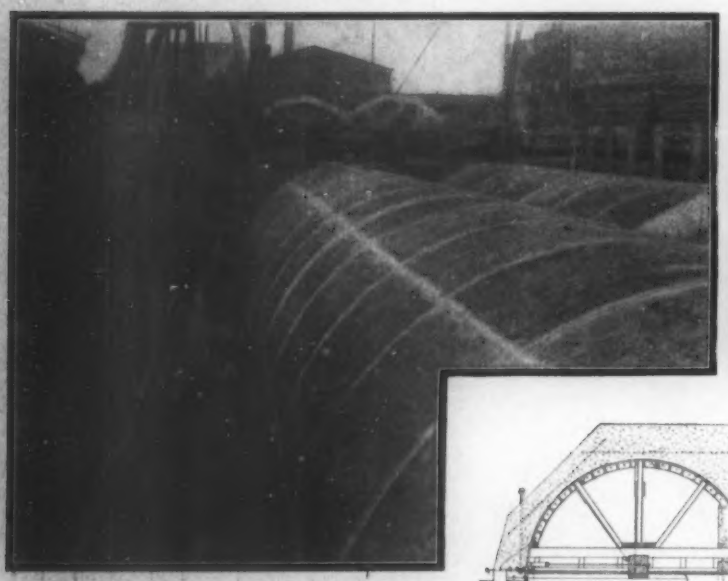
The improved method of construction may be described in detail as follows: As just stated, a channel was first dredged along the line of the tunnel, to a depth of about 12 feet below the top of the finished tunnel. Piling was then driven along each side of the channel to support two working platforms. In the channel, rows of foundation piles were driven at intervals of 8 feet. These were cut off about 20 inches below the spring line of the tunnel by a sawing machine traveling on the working platforms. The sheet piling was then driven in place to form the sides of the tunnel caisson. This sheet piling was made up of compound piles consisting each of three 12 x 12-inch yellow pine timbers, carefully planed to size and bolted together. A tongue was formed at one edge of the pile, and a groove at the opposite edge by fastening wooden strips thereon, as shown in one of our detail views. The tongue strip was made to extend somewhat below the rest of the pile, and the latter was tapered at its lower end in such manner that when it was driven it would be crowded against the pile previously driven, producing a tight joint therewith. In order to insure perfect alinement of the sheet piles, a guide frame was sunk to position on the foundation piles and brought to accurate lateral adjustment thereon, by means of wedge blocks. This frame was built with a pair of guide rails at each side, each pair being spaced apart the exact width of the sheet piles by blocks located at intervals of 8 feet. Between these rails the sheet piles were driven and were further guided by rails on the working platform.



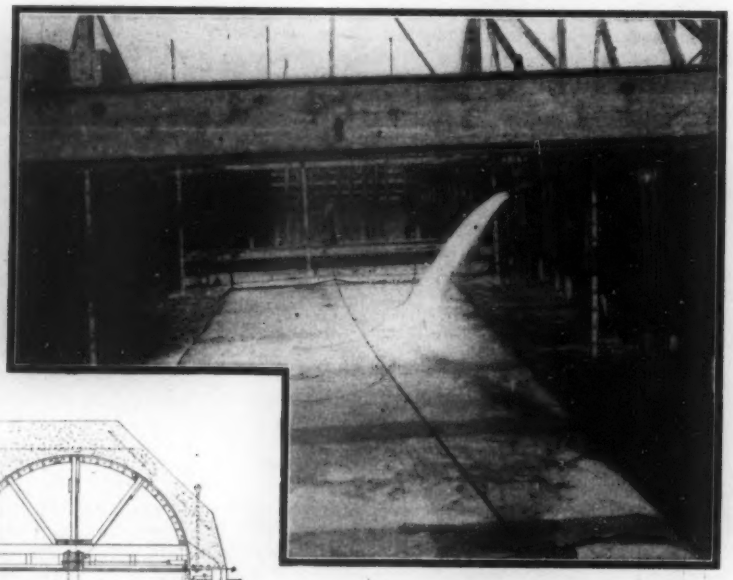
SHEET PILING USED FOR THE HARLEM RIVER TUNNEL.

A diver was stationed below to insure proper setting of the pile. Whenever a spacing block was reached he removed it, drilled a hole through the pile sheeting, and bolted the rails together against this sheeting. The diver also saw to it that a perfect joint was maintained during the driving of a pile. If any deflection occurred, it indicated the presence of a bowlder, or other obstruction. The pile was then withdrawn and three or four steel pilot piles were driven in its place. These either cleared the way for the wooden pile, or by the relative depth to which they would penetrate, indicated the form of the obstruction encountered, and the latter was then drilled into and dynamited. These pilot piles were but little used in the second half of the tunnel, as few obstructions were met with; but in building the first half of the tunnel they were constantly brought into use to locate the many bowlders encountered. In this manner the sheet piling was very closely fitted—so closely, in fact, that in the second half of the tunnel, for a length of 264 feet, the actual length of the sheet piling exceeded its theoretical length by a small fraction of an inch. After the two walls of sheet piling had been driven, they were cut off on the spring line by the sawing machine on the working platforms. The tracks on which this machine traveled were given the exact pitch or grade of the tunnel, and then by preserving the same reach of the saw shaft, the circular saw was made to cut the piling exactly on the spring line of the tunnel. This done, the work of assembling the upper half of the tunnel was begun. It was decided to build the tunnel roof in three sections of about 90 feet each, because, owing to requirements of grade, the entire length would make an awkward piece to handle. A pontoon was constructed between the working platforms, and in this the cast-iron sections of the tunnel shell were set up and bolted together. The ends of the half-tunnel were closed by vertical diaphragm plates, and the bottom was closed by a heavy wooden flooring. After the metal shell had been covered with concrete, which was molded to the form shown in our

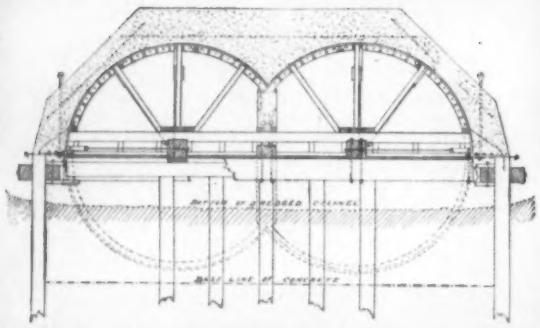
(Continued on page 8.)



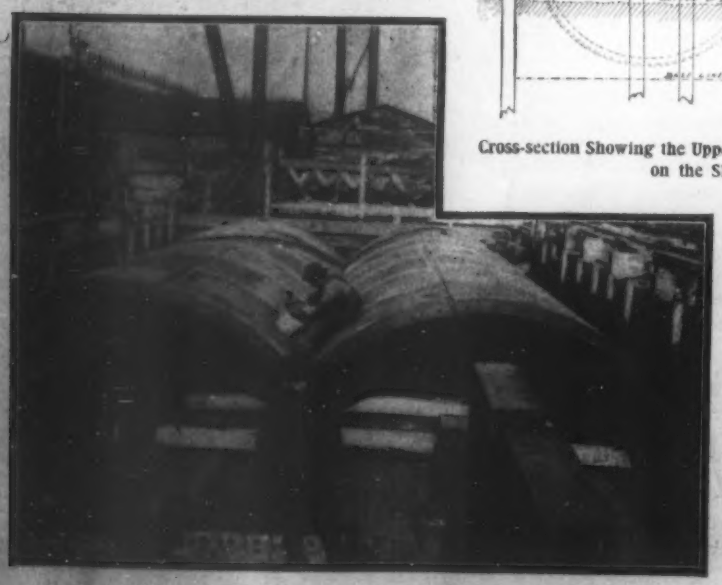
The Upper Half of the Tunnel Shell Assembled.



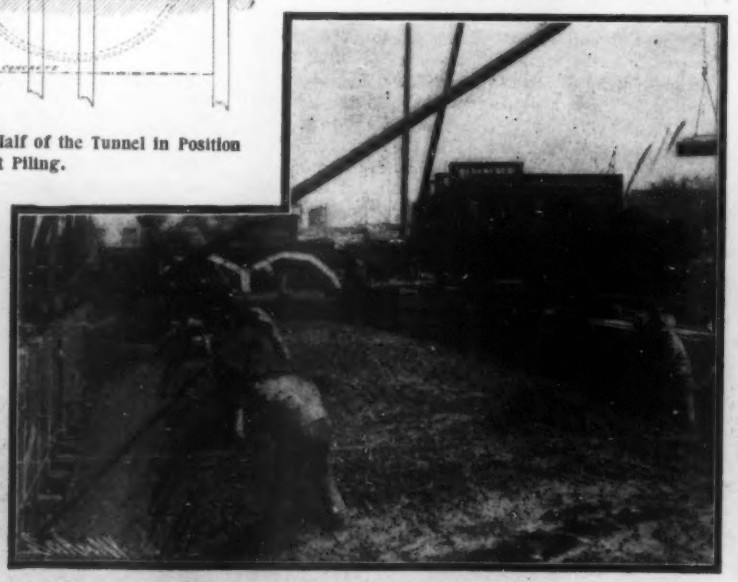
Sinking the Pontoon.



Cross-section Showing the Upper Half of the Tunnel in Position on the Sheet Piling.



Bolting Together the Cast Iron Rings of the Tunnel Shell.



Molding the Concrete Over the Tunnel Shell.

THE RAPID TRANSIT SUBWAY TUNNEL UNDER THE HARLEM RIVER.

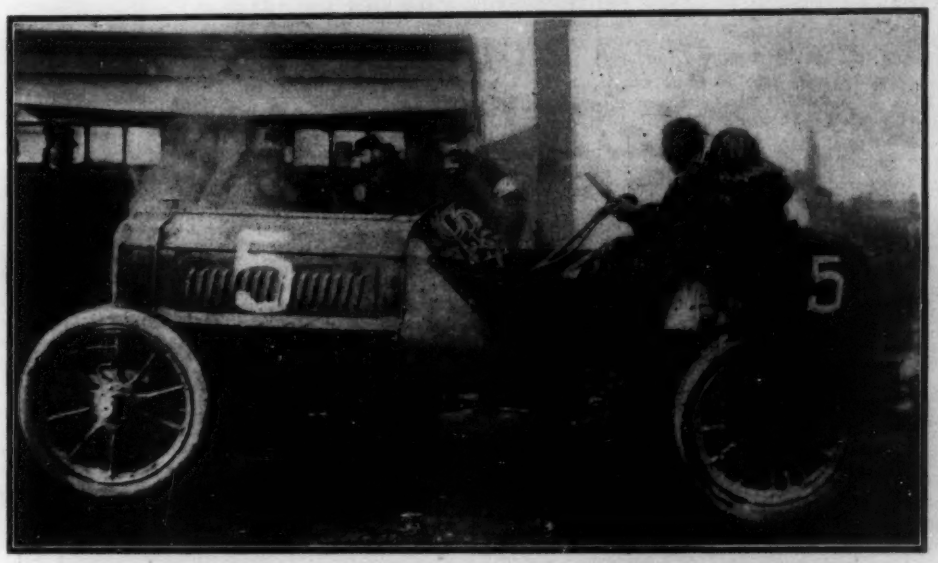
THE FIFTH INTERNATIONAL AUTOMOBILE CUP RACE.

The fifth time that the trophy presented by Mr. James Gordon Bennett has been raced for, was on June 17 last, when a 341½-mile race over an 85.38-mile course was run off in Germany. As a result of this year's contest, France once more holds the cup, for the race was won this year by the Richard-Brazier machine, which obtained first place on the French team in the eliminating trials. Driven in both events by M. Théry, this car has obtained a reputation for steady running that can hardly be surpassed. It is of only 84 horse-power, while that of most of the other racers was in the vicinity of 100; yet by its steadiness of running and freedom from breakdowns, it won the race, traveling at an average speed of 58.2 miles an hour. In the French eliminating trials it made an average speed of 61½ miles an hour. The two German Mercedes cars, driven by M. Jenatzy and Baron de Caters respectively, took second and third place. After the race these gentlemen claimed that it was the time taken in replenishing with fuel that lost the race for Germany, for the 90 horse-power Mercedes cars ran as regularly as usual.

There were no serious accidents during the race. Jenatzy nearly ran into a locomotive, which at one point stopped across the road, barring his passage; but fortunately he was warned in time. Herr Opel, on his Opel-Darracq (the third car on the German team) broke his rear axle while going fast, but escaped uninjured. Edge had a great deal of tire trouble with his English Napier; and Jarrott, on an English Wolseley car, had every conceivable kind of a breakdown. Besides England, France, and Germany, Austria, Belgium, and Italy were represented by three cars each. Various troubles put all of these cars behind or out of the race.

This greatest of all automobiling events for 1904 was started in the presence of the German Emperor at 7 A. M., and was completed in the afternoon, the time of the winner being 5 hours, 50 minutes, 3 seconds. Jenatzy, who won the cup last year, was beaten by 11 minutes and 18 seconds, while his companion, De Caters, was beaten by nearly an hour.

Following is a description of the winning Richard-Brazier car: The engine is a four-cylinder vertical one placed, as usual, in front, and covered with a square bonnet having radiator and fan in front. No water-circulating pump is used, the circulation being kept up on the thermo-siphon principle. The engine is fitted with high-tension ignition by magneto, and its inlet valves are mechanically operated. The car is fitted with a chain drive to the rear wheels, and has a three-speed transmission. Its wheel base and track are 2 meters 60 millimeters (6 feet 9½ inches approximately) and 1 meter 25 millimeters (3 feet 4 inches) respectively. The front wheels are 810 millimeters (32 inches) in diameter and the rear ones are 820 millimeters (32½ inches). The car weighs complete 972 kilogrammes (2,142.87 pounds).



THE RICHARD-BRAZIER CAR IN WHICH M. THERY WON THE INTERNATIONAL CUP.

TEST OF FIREPROOF STAGE PROPERTIES IN LONDON.

Ever since the terrible disaster which took place recently at the Iroquois Theatre in Chicago, when hundreds of lives were lost as a result of the fire which originated on the stage of the theatre, experiments have been made in almost every city of the United States, and even in Europe, with a view to rendering theatrical fabrics and scenery absolutely non-inflammable.

The subject has claimed the attention of managers everywhere, striving to secure some process that would render perfectly non-inflammable all the properties pertaining to the stage, rendering impossible a repetition of the Chicago disaster, or that there should be any fear in the minds of theatre-goers that so awful a catastrophe could happen again.

A London manager seems to have attained a fair measure of success in fireproofing the stage properties and costumes of his theatre—the Alhambra. Records of loss of life and property due to fires in places of amusement, show that in the majority of cases the trouble has started among some of the highly inflammable material that has been employed on the stage, the recent appalling disaster at Chicago being a case in point. Any measure, therefore, which will tend to guard against the possibility of a repetition of the Chicago disaster, and which removes the danger from an outbreak of fire in the most susceptible portion of a theatre or other place of amusement, is one which strongly commends itself to the attention of the public authorities, who are just now diligently seeking to discover some way or means of preventing fires in such places.

Several months ago a private exhibition of the fire-resisting qualities of the material used in the scenery and production of a popular ballet was given in the Alhambra Theatre, the experiments demonstrating the possibility of rendering the stage and its accessories absolutely proof against fire, even in the case of the flimsiest gauzes and the most delicate silks. Some of the costumes had been treated before being made up, and proved non-inflammable even when tested by the intense heat of a flaring gas burner and an electric arc.

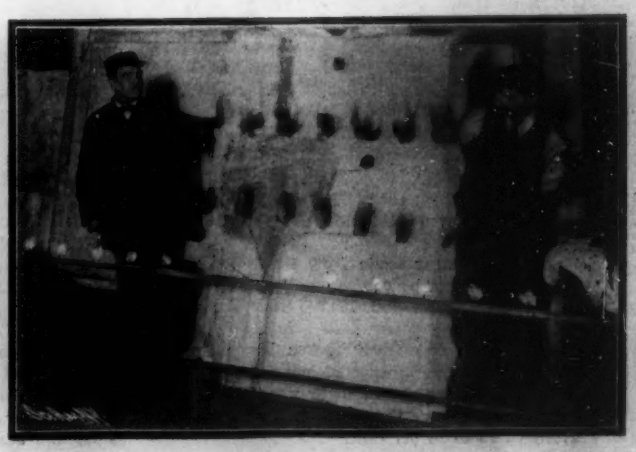
The curtain, when drawn up before a large gathering who had been invited to witness the test, showed the stage area littered with "properties," from ordinary table and chairs to plants, pedestals, fragments of a sylvan wing, and a portion of a vine-clad veranda. Near the footlights, and parallel with them, a gas-pipe, with a dozen flaring jets, lay supported by a pair of trestles. A number of men occupied the stage, among whom were firemen, standing close to buckets of water.

The process of imparting the quality of non-inflammability took place with the raw material, so that the details in a stage bouquet had been treated before being made up into the finished article.

A merely superficial application of fire-resisting solution was demonstrated to be little better than useless. The solution must be forced into every pore and fiber. Ordinary canvas applied to one of the gas jets speedily flamed, but similar canvas which had been treated with the solution employed, was held in the flames of four or five burners without more than carbonizing. The same result was obtained with linen, with argentine, with light gauzes. In the case of a sable-hued gossamer gauze, the flaming was so swift with the untreated articles, that the attendant fireman had barely time to plunge it into his bucket of water. With the corresponding article treated, a red-edged smoldering could be seen, but no flame.

Subjecting a Piece of Gauze to a Ten Minute Flame Test.

Drop Scenery After a Test, Showing Purely Local Effect of the Flame.



After an Hour's Contact with the Flames.

TEST OF FIREPROOF STAGE PROPERTIES IN LONDON.

Cotton wool, used on the stage for fruit, snow effects, etc., as well as all the varieties of paper employed, were successfully subjected to the same tests. Dress fabrics, plushes, draperies, and baize, all alike refused to break into flame, though held in the flaring gas jets long enough to be consumed by dozens of yards, if untreated.

What is technically known as a "profile," or tree form wing, was propped against the row of gas jets and left there for twenty minutes, with no other consequence than that the wood had been charred through, and broke on being handled; artificial flowers in garlands resisted ignition in varying degrees, the dyes used for pink, and perhaps one other color, having presented an admitted obstacle.

During the progress of the interesting experiments, a director of the theatre wrapped himself in a white sheet and passed himself along the row of jets, to be burnt. They would not, however, burn him, although in the case of the scenery "cloth" lowered down upon the men on the stage, they left blank patches and holes. The flimsiest kinds of clothing were lowered from the "flies" until they reached the flaming jets, but they were merely discolored.

The greatest interest was taken in the experiments with wood. The solution to fight fire is not merely applied to the surface, but is forced into every pore and fiber of the wood, and does not interfere with the polishing, where polishing is required. When this has been done, it is possible successfully to apply the test of abnormal heat to a splinter taken from the center of a block of wood.

A severe test was made during the experiments at the theatre, showing thoroughly the effect of the fire-resisting solution on the impregnated timber and the various species of material used in stage production.

Not satisfied with holding fabrics and scenery in the flames, or having great sheets of them lowered into the gas jets from the roof of the theatre, one of the directors had two powerful electric arcs lighted, and ordered successively timber, drapery, and other materials to be placed in the glowing arc. The pieces flamed as before, but certain pieces of every material that he tried to ignite, even including the cotton wool and paper, would do nothing but consume away in smoke.

Articles subjected to the fire-resisting treatment emit a smoke, but this is considered far less suffocating than the fumes from material which is not so treated.

The secret revealing the ingredients of the fire-proofing solution so successfully employed by the manager of the Alhambra has not yet been divulged, but it is promised ere long that the theatrical world at large will be made fully acquainted with this preparation.

Progress of the Beet Sugar Industry, 1903.

A report on the Progress of the Beet-Sugar Industry in 1903, prepared by Charles F. Saylor, special agent of the United States Department of Agriculture, and printed by authority of Congress, is about to be issued. It shows that there has been an increase in the number of beet-sugar factories in the United States from 43 at the close of 1902 to 56 at the beginning of 1904. Fifty of these were in operation during the "campaign" of 1903.

According to the report the sugar-beet crop of 1903 amounted to a little more than 2,000,000 tons harvested from 242,576 acres, the average yield being about 8½ tons to the acre. The prices which the farmers received for beets from the different factory companies ranged from $4.50 to $5.60 per ton, the average being nearly $5. The average gross returns to the farmers were, therefore, $42.50 per acre. The estimated cost of growing beets by irrigation is $40 per acre, and in sections where irrigation is not necessary, $30. If $35 be taken as the average for the whole crop of 1903, the average net profit to the farmers was $7.50 per acre. In some of the sugar-beet areas, the returns were very much higher than this general average. As in the production of other crops, much depends on the season, the character of the land, and the kind of farmer who grows the beets. Many farmers have cleared from $25 to $50 per acre. The best result on record for 1903 was secured by a farmer of Otero County, Colorado. He grew one acre of sugar beets at a cost of about $37.50; the yield of beets was 33 tons, for which he received $158, his net returns being about $130.

The amount of sugar made from the beet crop of 1903 was 240,604 tons, as compared with 218,405 tons from the crop of 1902, and 184,605 tons from that of 1901.

Within the past few years there has been a remarkable increase in the percentage of sugar in the beets. A few years ago 12 per cent of sugar was the standard. Last year in many cases the entire crop sold to a factory averaged 15 to 18 per cent.

There is a prospect that many new factories will be built in the next year or two. Many improvements are being made in methods and machinery used in the growing and handling of beets. The beet pulp produced by the factories is used by the farmers as feed for their stock more generally than heretofore.

The report will be for distribution by Senators, Representatives, and Delegates in Congress, and by the Department of Agriculture.

Engineering Notes.

After prolonged delay the Italian government has at last introduced the measure sanctioning construction of the Apulian aqueduct. This project consists of an irrigation system for the arid tableland of Apulia. The aqueduct is to cross the Apennines by means of a tunnel 7½ miles long, and will have several subsidiary canals, so that twenty-one communes of the province of Foggia, and all those of the provinces of Bari and Leece, will receive an adequate supply of water. These communes contain a population of nearly two millions. It is estimated that the scheme will cost $25,000,000, and will not be completed before the year 1920.

Owing to the complete success that has attended the irrigation of the land by the erection of the barrage at Assuan on the Nile, a scheme is being formulated for increasing the height of the dam by 19 feet 6 inches. The realization of such a project will enable the Irrigation Department to retain behind the barrage an additional thousand million cubic meters of water, which will suffice for an increase to the perennially irrigated area of half a million acres and add $75,000,000 to the wealth of Egypt. According to the recently-published report of the Assuan reservoir compiled by Sir William Willcocks, late Director-General of Reservoirs, the whole of the water kept back by the dam has been devoted to special tracts, and the Egyptian government cannot entertain any applications for water. The cost of raising the barrage will involve an expenditure approximating $2,500,000, which sum will be defrayed out of the public debt surplus.

A more hygienic and expeditious system of emptying cesspools is to be experimented with by the Rumford Rural District Council in Essex (England). The apparatus comprises a double-cylinder steam-propelled motor carrying a large galvanized-steel tank with a capacity for 700 gallons of sewage. The tank is filled from the cesspool by suction, a steam air pump being attached to create a vacuum for this purpose. The foul sewer gas liberated by the disturbance of the fæcal matter is exhausted from the tank and passed through the boiler furnace where it is consumed, so that the whole work can be done without creating a nuisance. The motor will travel at speeds varying from six to eight miles per hour, will be fitted with reversing gear, and, in addition, a special device for rope haulage, should the machine get on soft ground from which it cannot propel itself.

It is a singular fact that the two great coal-bearing formations of the United States, viz., Carboniferous and Cretaceous, should be so widely separated. The first is found east of the Missouri River with its greatest development in the Appalachian region, and the second west of the 105th meridian. Yet, it is extremely fortunate for the operator that this separation exists since the great treeless plains intervene and furnish a growing market for his product, particularly for that of the mines situated on the eastern flanks of the Rocky Mountains and facing the so-called arid plains. Coking, gas, steam, and domestic coals occur along these hills, in Colorado with some breaks, from New Mexico to Wyoming. The arid plains are fast being dotted with towns containing manufacturing, lighting and power plants, and the market constantly grows, its eastern limit being practically the Missouri River. The coking-coal deposits are the most valuable and are situated largely in the southern part of the Raton field in Southern Colorado and Northern New Mexico.—Mines and Minerals.

An electric railroad is to be constructed up Mont Blanc on plans prepared by M. Ballot. The cog-wheel system as used on the Jungfrau road is to be adopted. The railroad will start from the village of Les Honches, 3,260 feet above sea level, and will climb 11,710 feet to the upper terminus, at a point near the Petits Rochers Rouges. The track will be nearly eleven miles in length, of which more than sixty miles will be in tunnels. The first station will be at the top of the Gros Bechand, 8,410 feet high, from which point of vantage a splended view of the Chamonix Valley is obtained. The second station will be just below the summit of the famous Aiguille du Gouter, at an altitude of 12,600 feet. Thence a hard snow path will lead to the Grand Plateau. The third station will be located in close proximity to the observatory and the refuge hut, at an altitude of 14,300 feet. From here a tunnel will be cut through the northern slope of Mont Blanc proper to the terminus, situated 14,970 feet above the sea. The highest summit, 810 feet above the terminus, will be reached from there on foot or by sledge. The entire train journey will only take two hours.

THE RAPID TRANSIT SUBWAY TUNNEL UNDER THE HARLEM RIVER.

(*Continued from page 6.*)

cross section of the tunnel, the pontoon was sunk, lowering the tunnel section into the water until it floated. One end of the pontoon was now removed, permitting the pontoon to be drawn out from under the tunnel section. Loose stone was loaded onto the tunnel structure, until its buoyancy was overcome, when it was lowered to position on the sheet piling by slacking off on the sixteen supporting tackles. Careful measurements were taken to bring the section to perfect alinement before it was lowered. A diver now removed a plate of the tunnel shell, entered therein, and bolted the end flanges of the tunnel to the flanges of the shore section. After the plate had been again bolted in place, the water was pumped out of the tunnel and air pumped in. It will be observed from our section view, that along the horizontal flanges of the tunnel, angle iron strips are secured, just outside the line of sheet piling. Between these strips and the piling, wooden blocks were driven to wedge the tunnel shell in place. So accurate was the alinement of the piling that the greatest variation discovered between the piling and the angle strips was less than half an inch. While the upper half of the tunnel was being constructed, metal tubes were set in the concrete, and by means of long rods passed through these tubes, drift bolts were now driven into the upper ends of the sheet piles, securing the horizontal flanges of the tunnel to them.

The same process was followed in sinking the other two tunnel sections, the last section having been successfully lowered in place two weeks ago. Mud is now being dumped on the tunnel to completely bury it, and to entirely overcome its buoyancy. The diaphragms which separate one section from the other are cut through, and the process of excavating the bottom of the tunnel to the required grade is under way. As soon as this is done the lower half of the tunnel shell will be assembled, and the concrete backing filled in.

It will be observed that this method of tunneling is much simpler and less dangerous than the shield method now commonly in use. In fact, the shield method could not have been used in constructing the Harlem River tunnel on the grade required, because the mud which forms the bottom of the river is too thin to support the necessary air pressure, and even if the shield were driven through at a much greater depth than that of the present tunnel, blowouts would be sure to occur. In the shield system of tunneling, a great deal of trouble arises from the fact that the air pressure at the top of the shield is just as great as that at the bottom, whereas a greater pressure is required at the bottom than at the top; and it is due to the impossibility of regulating this pressure as required for different parts, that blowouts occur. In the new system conditions are entirely changed and these difficulties are avoided.

The feasibility of building a tunnel under the Hudson or East River by this system has not yet been put to a practical test; but we see no reason why it could not be successfully done, and much more quickly and economically than with a shield. The work could be done in short sections, and could be attacked from a number of different points at once. While the dredging is being done in one section, the piling could be driven in another; at the same time workmen could be assembling the tunnel roof, while in a third section the lower half of the tunnel would be under construction within the tunnel caisson. Speaking of the application of this system to the Hudson and East River tunnels, Mr. William H. Burr, of Columbia University, who was recently appointed a member of the Panama Canal Commission, says: "No methods or procedures other than those employed in the Harlem River work would be needed in the construction of these tunnels, nor would the adaptation of these methods to the greater depth of work in the North and East Rivers involve any special difficulty. The requisite dredging would be carried on at no greater depths than those already reached in successfully conducted dredging work already completed at a number of points. In this system of tunnel construction, any shape desired may be given to the cross section, also any combination of metal tubes and concrete, either plain or armored, may be employed, or again a structure of all concrete steel may readily be built. Furthermore, a twin double-track tunnel may be as readily built as a single tube. Such a double-track tunnel with its great mass would possess materially increased rigidity and resistance to vibration under passing trains over two single-track tubes. This system of tunneling permits a much more rapid rate of working than other methods with which I am acquainted. It is reasonable to estimate that a double-track tunnel under the North River could be completed within two years from the time of beginning the work."

John G. Meiggs recently died in London. He was best known to engineers for having built the famous Oroyo Railroad.

Correspondence.

A Simple Home-made Condenser.

To the Editor of the SCIENTIFIC AMERICAN:

A method I use for coating the inside of Leyden jar condensers may be of interest to some of your readers. After getting the bottle chemically clean, I siphon into it, carefully and to the proper height, one of the usual silvering mixtures, leaving the siphon in place until the exhausted liquid is to be drawn off and avoiding any effect upon portions of the glass not meant to be silvered. After drying and before sealing up, I run in some shellac varnish, flowing it about the upper parts of the flask, and then heat to drive out all moisture. Besides its other advantages, this method does not restrict one to the choice of wide-mouthed flasks, and so makes it easier to secure glass of the proper thinness, resistance, and specific inductive capacity.

(Rev.) I. J. KAVANAGH, S. J.

Loyola College, Montreal, June 16, 1904.

The Shrinkage of Great Salt Lake.

BY CHARLES ALMA BYERS.

Statistics indicate that Great Salt Lake, the Dead Sea of America, is doomed—that it is gradually drying up. The opinion now almost universally prevails among scientists that this mysterious body of water, located at an altitude of 4,210 feet above sea level and 1,000 miles inland, and which has but a single rival, the Dead Sea of Palestine, is certain within the course of a half century to disappear from the map. Some scientists, who have made a careful study of the fluctuations of the lake for the past several years, even declare that it will be dried up within a quarter of a century.

Various statistics of climatic conditions, including precipitation records, are complete for Utah back to 1863, with scattering accounts for many preceding years, and it has been possible from these data, although the problem is far from being a simple one, to arrive at these and other conclusions—conclusions so well founded, as shall herein be shown, that the predicted destiny of the lake can not well be disputed.

The lake is subject to annual fluctuations, which, up to the first of July of each year, give a rise of water level usually amounting to about twelve inches; after July first it begins to fall, and the fall is invariably greater than the preceding rise. We have statistical proof that this has been going on for 35 years. In the meantime, however, in addition to the lake's annual fluctuations, there have been wet and dry cycles which temporarily affect the lake's level to a very great extent. During one of these wet cycles the level may rise several feet, but, like the annual rises, it always fails to reach the mark set by the preceding one. In drawing conclusions these facts must necessarily be taken into consideration.

From the close of the year 1886 to the close of 1902, sixteen years, there has been a total fall of 11½ feet. While this is considered alarming, measurements show that the shrinkage has been even more rapid during the past three years than for any other like period in the sixteen, the average fall being 1 foot per year—that is, 1 foot after deducting the preceding annual rise. At this ratio, in forty years the level will be a corresponding number of feet below its present standard, which means that the lake bottom will practically be a dry, salt desert. The water in what is known as the north arm is now a little less than 40 feet deep, and this is considered the deepest portion of the lake.

This is one way of reckoning the time until the Great Salt Lake will cease to be. Here is another:

Sixteen years ago, in 1886, the area of the lake's surface was estimated at about 2,700 square miles. Taking 20 feet as the average depth at that time, we have 1,505,433,600,000 cubic feet as the contents of the lake. To-day, according to recent surveys, the lake has an area of about 2,125 square miles. Multiplying this number by 11½, the number of feet in depth of the water that has disappeared and not been replaced, gives 669,778,400,000 cubic feet as the quantity of water less than what it had sixteen years ago; or, leaving 835,655,200,000 cubic feet as the lake's present contents. At this ratio of decrease in quantity in less than twenty-five years the lake will be waterless.

This latter reckoning, however, is valueless unless it be proved that the water disappears entirely by other means than evaporation, for the quantity consumed in this way will depend largely upon the area over which it is spread. It is also made less reliable on account of it being impossible, owing to the fluctuation in the volume of water incident to climatic variations and conditions, to get at the real dimensions of the lake. And again, much more than 669,778,400,000 cubic feet of water has disappeared in the last sixteen years, for the reason that the lake has been gradually growing smaller in area and that no estimate was included of the water that covered the area now completely dry. As to evaporation being a cause for the drying up of the lake, that theory, with others, will be considered later.

To show the effect of cycle fluctuations and how the lake is steadily shrinking despite temporary rises, a chart has been prepared indicating the action of the level for the past forty years, commencing with 1863. The level then stood at two feet above the zero point. For the four years following the precipitation was very great. In consequence of this the level went up at almost the rate of two feet a year until 1868, when it stood at 13½ feet above zero—the highest level on record. Then there was a turning point, and in the next five years there was a drop of 7½ feet. Again there was an increase in the precipitation and the lake's level rose until in 1875 it reached 12½ feet above zero.

It is from this year forward that the real shrinkage of the lake becomes evident. A steady decline has been in progress since then, and only once has there been a rise of any consequence. It began in 1883 and continued until 1886, when the level registered at 9 feet above zero. Now the precipitation preceding this rise was only 1 inch less than that which preceded the rise of 1875, yet there was a difference of 3½ feet in the two water levels.

In 1900 the greatest fall on record was registered, and during the year the level went down nearly 4 feet. This occurred despite the fact that the rain chart shows that the precipitation for five years preceding this time was above the normal. The lake now stood at 1 foot below zero. During 1901 it fell only 2 inches, but again in 1902 it took another downward leap, reaching 3½ feet below zero. In June of the past year, 1903, the season at which, according to previous records, the level usually stands at the highest point, it was 3 feet 9 inches below zero, and still falling. The annual rise this year amounted to about 1 foot as usual, and yet it is more than 2 feet lower than it was this time last year. The precipitation this year, too, has been much greater than it was last. It is therefore seen that the total fall from 1886 to June of the present year amounts to 11 feet 9 inches—a fall that has occurred despite normal precipitation.

Such has been the history of the rising and falling of Great Salt Lake since the white man has become its observer. Its actions before that time can only be summarily told by the lake's surroundings; and a geological investigation of the nine mountainous islands within the lake and of the higher elevations inclosing it, discloses evidence that once the level approximated about 600 feet above the present surface. This evidence is in the nature of ancient water marks on the sides of the elevations.

Observers of the lake have assigned three causes for the shrinkage of its water. They are evaporation, irrigation, and that there is a subterranean outlet. There are ardent advocates of each of these theories.

As to there being a subterranean outlet to the lake, evidence in support of the theory is not very plentiful, yet many think it probable because there are other lakes not far distant which have underground outlets; also because of there being mysterious "sinks" for some of the rivers across the line in Nevada. Because the water mysteriously disappears they think this is a likely reason. Then, too, a few years ago the owner of Antelope Island had a sailing vessel go down in the lake with two hundred sheep on board as though it sank in a maelstrom. None of the sheep ever appeared on the surface.

The evaporation theory is somewhat in contradiction of the subterranean outlet theory. It is thought that if the lake had an outlet of any kind the water would not contain as much salt as it does, whereas if the water disappeared by evaporation all solids which found their way into the lake would naturally remain. Of course it is but natural for a great deal of water in any lake to disappear by evaporation, and as this body of water is situated where the atmosphere is very dry, a much larger quantity is certain to evaporate than would elsewhere.

The supporters of the irrigation theory have more evidence to produce. When Brigham Young and his followers invaded Utah in 1847, they found the soil to be suitable for farming in every way except that it lacked water. They, being largely of the farming class and in a new country, had to till the land, and to do so, in the following year, 1848, they began to irrigate their new farms. This system grew only very gradually and slowly for several years—in fact, until about 1880, or a little later. In the meantime the lake was seemingly not affected, for it went up and down according to wet and dry cycles. About this time, however, irrigation was begun in the State on a very extensive scale. The effect is seemingly shown in the wet cycle of 1886, when the lake failed to rise in proportion, as determined by preceding wet cycles, to the precipitation. It lacked 3½ feet. The steady growth of irrigation continued, and in 1899 there was irrigated land amounting to 609 square miles, which was double the amount under irrigation ten years previous. Meantime the level of the lake went down; and as much greater irrigation facilities are now being planned, the decline of the lake is expected to be proportionately greater. Therefore it seems that the lake's shrinkage will soon be averaging even more than a foot a year.

All the water that is used for irrigating purposes in Utah Valley comes from the streams that empty into Great Salt Lake. The principal ones are the Jordan, the Weber, and the Bear rivers, the first named being the outlet of Utah Lake. There are several smaller streams, or creeks, and the water of some of them is completely sidetracked for irrigation before it gets out of the mountains, leaving the lower portions of the creek beds entirely dry. It is in this way that the feed streams have been tapped, which naturally caused the flow into the lake to be greatly reduced—so much, in fact, that the precipitation has very little effect apparently on the lake's level.

This theory seems the most probable, and especially so since the water of the lake should not disappear more rapidly either by an underground outlet or by evaporation now than it did years ago; which it is evidently doing. In summary, it seems that, owing to the decrease in the water that reaches the lake caused by extensive irrigation, the atmosphere absorbs more water than the lake receives from its feed streams. Thus have scientists evidence to support their declarations that the lake will gradually dry up.

Electrical Notes.

A series of wireless telegraph receiving stations is about to be organized round the French coast by the French Minister for Posts and Telegraphs, to be used by private as well as government vessels.

The electric traction experiments on normal-gage railways, made since August 15 of last year by the Union Elektrizitäts Gesellschaft, Berlin, with their high-tension single-phase alternate-current system on the Niederschönweide-Spindlersfeld line, have resulted in the electrification of this line. Trains comprising two motor cars and three trailers have been run since June 1. The motor cars are placed at the ends of the trains. No increase of the speed is contemplated for the present moment, the intention of the railway department being to obtain trustworthy data as to the working cost of the new system.

At the meeting of March 22 of the Elektrotechnischer Verein, Berlin, Mr. E. Ruhmer delivered an address on the importance of selenium for the electrical industry. After giving an historical sketch of the discovery of selenium by the Swedish scientist, Prof. Berzelius, Mr. Ruhmer briefly explained the properties of the various modifications of this body. The sensitiveness to light characteristic of the crystalline modification has been utilized in connection with the design of the so-called selenium cells, consisting mainly of a selenium resistance prepared after a special process, so as to afford the highest sensitiveness to light. As by the increase in the conductivity of selenium, due to illumination, the current intensity in a circuit is altered, these devices will act in a way quite similar to an electric cell proper. Mr. Ruhmer showed by some interesting experiments the fluctuations in the intensity of a current traversing the selenium cell, as produced by variations in the luminous intensity. A glow lamp connected in series with a selenium cell was, for instance, shown to give a dark-red light while the selenium cell was in the dark, while an intensely white glow was noted as soon as the cell was exposed to the action of light. The action of extremely rapid fluctuations in the luminous intensity was illustrated with the aid of a rotating disk, having circular rows of holes, through which a selenium cell was illuminated. The cell was connected to a battery and a loud-speaking telephone, which, with the alternating illumination and darkening of the cell, would yield a loud sound, heard throughout the hall. As regards the numerous practical applications of selenium, the selenium photometer, serving to measure luminous intensities, and the electric telephotographic apparatus designed by Prof. Korn for the transmission of handwriting, pictures, and [illegible]tographs, were discussed at some length. Selenium ignition devices, lighting automatically gas or electric lamps at the fall of night and extinguishing them at daybreak, were shown, and the application of selenium cells to wireless (optical) telephony was finally described in detail. In connection with the latest experiments made by the author between Berlin and Grünau, a transmission of language, by means of rays given off from a projector, was secured over a distance as high as 15 kilometers (9.31 miles). The first experiments made in this direction outside of a laboratory were Herr Ruhmer's well-known Wannsee experiments.

Prize in Chemistry.

A prize of 1,200 marks ($285.60) is offered by Prof. Van t' Hoff, of Berlin, for a collection and systematic arrangement of the entire literature with reference to catalytic phases. Competitors are requested to forward their work up to June 30, 1905, to the Zeitschrift für Physikalische Chemie, of Leipzig.

SOME UNUSUAL USES FOR FIRE-ENGINES.

BY W. G. FITZGERALD.

The builders and designers of fire-engines in Great Britain are frequently called upon to design steamers of special pattern and design for rather remarkable work, other than fire extinguishing. For example, quite a number of handy fire-engines capable of throwing two hundred gallons a minute were used with conspicuous success throughout the South African war, for supplying large bodies of impatient and thirsty troops with water.

This little steamer, which can be readily lifted off its wheels and carried on poles by six or eight men, is frequently carried into the wildest and most rugged country, where roads and rails are alike unknown. It is often used in collieries, for pumping out water in the case of a shaft being flooded. The Natal Government Railways have also adopted this little steam fire-engine for supplying water at their stations to locomotive boilers and tanks; and it has been arranged to burn wood in regions where coal is not available.

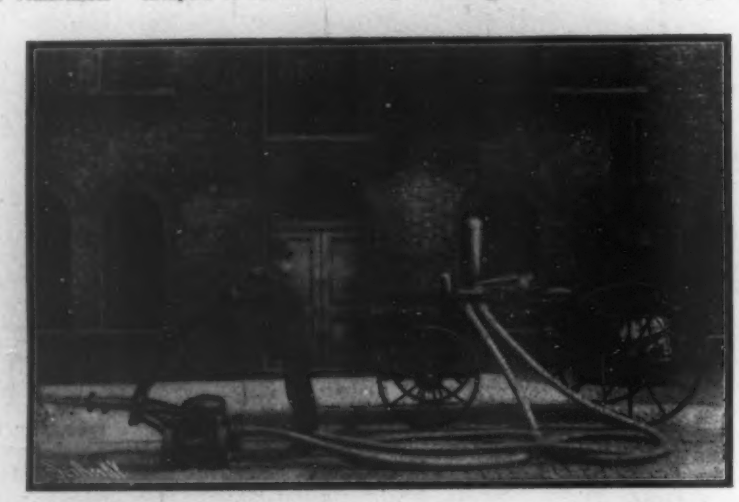
Another small steamer of like pattern is used in the country districts of England, not only for putting out fires and supplying water, but also as a motor for driving farm, stable, workshop, laundry, and other machinery. All that is necessary is to put a belt on the flywheel, and the little fire-engine will promptly light the house with electricity, cut timber, make butter, and drain the fields. This little engine weighs about seven hundredweight, yet will throw a hundred-foot or ninety-foot jet with great force, and, moreover, will raise steam from cold water in ten minutes.

There is an even smaller pattern of this steamer made, which will throw eighteen hundred gallons an hour onto lawns and tennis grounds; and several of these engines are used to water important cricket grounds, like the famous Lord's, and race courses like Ascot and Epsom.

Not the least remarkable of the duties which steam fire-engines are called upon to perform in Great Britain is the digging of holes, driving piles, and rooting up tree-stumps by the direction of a powerful jet at the roots.

A very interesting instance of pile-driving in the sand by means of a fire-engine was shown recently in Blackpool, the popular Lancashire watering place. The work was done in connection with the new pier works, and the contractor, Mr. Robert Finnegan, decided to adopt the water-jet system, in which a powerful flow of water is maintained at the front of the pile, so loosening the sand that the pile will often sink by its own weight. In the present instance ten piles, each fifteen feet long, were sunk in the course of a tide, say four or five hours; whereas driving them in the usual way, no more than two or three could have been driven in this time. A bed of gravel was encountered by the jet four feet below the beach level, but the irresistible rush of water passed through this without difficulty. Even large bowlders were shifted to one side by the rush of high water pressure.

From this it is a natural transition to consider fire-engines that may be said to dig for gold—"hydraulicking," as it is commonly called. This is perhaps the cheapest of all methods of gold mining, for if it be adopted, gravel containing no more than six or eight cents per ton of gold will pay respectable profits.



FIRE-ENGINE INTENDED FOR HYDRAULIC MINING OF PRECIOUS STONES.

Let us consider the case of the Jirnkee Hydraulic and Sluicing Gold Company, whose property is situated at Cassilis in the Australian colony of Victoria. The company estimates that with one jet there are thirty years of profitable work before them. The whole of the alluvial wash-dirt is sluiced, and the gold extracted. The tremendous pressure of water of 271 pounds to the square inch is obtained; and there is a giant nozzle, or hydrant, directed against the face of the wash dirt, from which the gold is afterward collected by means of quicksilver. The value of gold obtained beyond a cost of six cents for each cubic yard is all profit; and it is estimated that 672,000 cubic yards will be treated in a year, yielding a net profit of $697,200.

There is a tragedy connected with this very jet of water. One day, not very long ago, the manager of the company was explaining the action of the tremendously powerful jet to some friends on the company's property, when by some accident the nozzle was directed against himself, and he received the full impact of the water. The unfortunate man was not only killed outright by the terrific blow so received, but his body was hurled forty or fifty feet away onto some stones.

Some fire-engines of this kind are in use in the famous ruby mines in Burma, being carried thither on elephants.

One has next to consider the fire-engine as an agricultural implement in Great Britain, where it has largely superseded the old tedious hand-work for spraying insecticides on crops of all kinds. Take, for example, the hop crops of Kent, which must be kept scrupulously clean, in order to eliminate insect pests.

The Kentish farmers have found there is nothing like a powerful fire-engine for spraying hop vines. Some of the farmers tried hand pumps in portable cisterns, which contained a mixture of water and chemicals; and even horse power was tried for throwing the insecticide; but it was found, however, that the cleansing liquid so thrown did not reach the underside of the leaves and flowers.

With a fire-engine twelve jets can be worked simultaneously, and with great power. The steam pump is mounted upon a small quick-steaming boiler, the whole apparatus weighing only about five hundredweight, and being capable of transportation from one plantation to another by means of a horse or bullock. Besides throwing insect and fungus killers, the steamer can also be used to irrigate the plantation in dry weather.

An acre and a half of hop plants can be thoroughly sprayed by one man in a day at an all-round cost of $1.88 per acre, including fuel for the engine. When one considers that the average yield per acre of hops is supposed to be $170, and that this is often reduced sixty per cent through a bad blight, it is easy to see that in a hop garden of several hundred acres, a great saving may result from the use of the fire-engine.

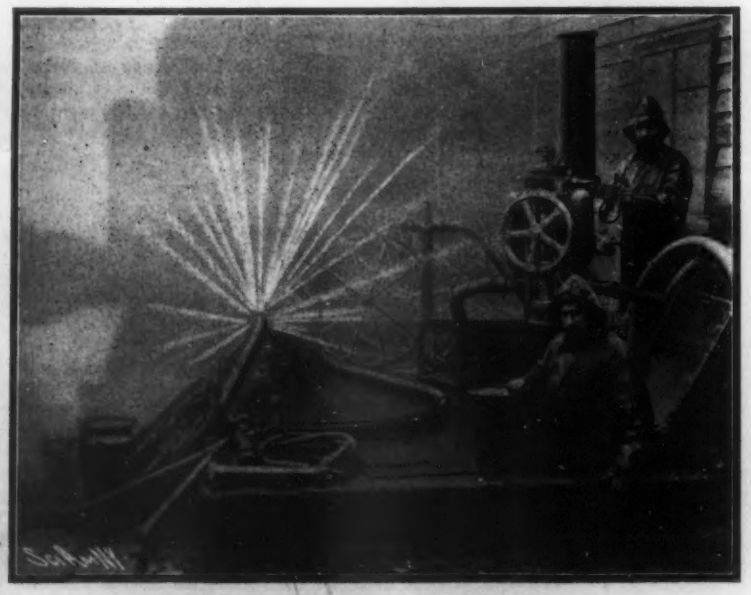
These little steamers are also used in the Kentish fruit orchards. Mr. Isaac Reeder, of Paddock Wood, in Kent, has sprayed in this way twelve acres of apple trees in one day.

Similarly, the managers of tea plantations in India and Ceylon now use fire-engines in increasing numbers for spraying the tea plants with insecticides; and the whole of the apparatus can be transported from one plantation to another by a light four-wheeled carriage, with reels for hose, racks for piping, tanks for the chemicals, and an attachment for towing the fire-engine behind. The plants, when without their leaves, can be sprayed

(*Continued on page 12.*)

THE FIRE-ENGINE USED AS A MEANS FOR SPRAYING HOP VINES.

A FIRE-ENGINE USED IN PILE DRIVING.



THE FIRE-ENGINE USED FOR FLUSHING SEWERS.

JAPANESE NAVAL GUNS.

Japanese guns, at least nearly all those of modern pattern, are British in design. Till lately they were imported, but pieces up to 8-inch are now made in Japan, on British models.

The standard battleship gun is the 12-inch Elswick of 40 calibers. It has an initial velocity of 2,423 foot-seconds, an energy of 34,600 foot-tons at the muzzle, and fires an 850-pound shot. Weight, 49 tons. All the first and second class battleships have this gun.

The 8-inch is a rapid-firer, Elswick pattern, 40 calibers long, maximum velocity 2,242 foot-seconds with a 210-pound projectile, and 2,068 foot-seconds with a 250-pound one. Energies, 7,219 and 7,413 foot-tons respectively. The gun weighs 15½ tons, and is mounted in all the armored cruisers—a similar piece, Italian-built on Elswick lines, being on the "Nisshin" and "Kasuga." It is also on three of the "Takasago" class.

The standard 6-inch is the 40-caliber Elswick with 2,500 foot-seconds velocity, weighing 6½ tons; though some of the older ships have a 6-ton gun of 2,250 foot-seconds only.

Protected cruisers carry an Elswick 4.7 of 40 calibers and 2,150 foot-seconds. Old cruisers like the "Matsushima" have a 32-caliber 4.7 of 1,938 foot-seconds. It weighs 1 2-3 tons, the later piece weighing 2 tons. The 4.7 is now discarded for new ships.

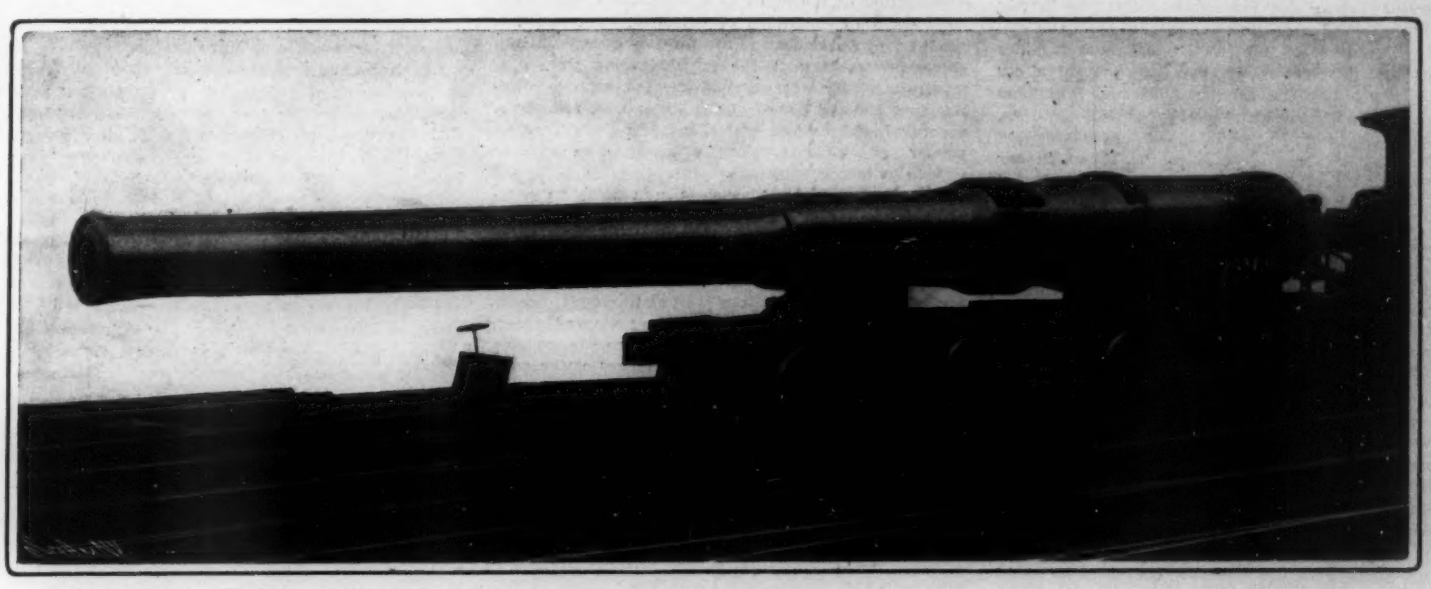
The new cruisers "Niitaha" and "Tsushina" carry a Vickers model 6-inch of 50 calibers. Its velocity with nitro-cellulose is 3,000, its energy 6,240, and it weighs 8 tons. The nominal penetrations of these pieces, firing capped A. P. shot against K. C. armor at 3,000 yards, are:

	Capped.	Uncapped.
12-inch	15½	12½
8-inch	7½	6
6-inch 50 cal.	6½	5
6-inch 40 cal.	4½	4

There are also in the Japanese service an old but very powerful 12.6 Cervet gun, equal to 16 inches K. C. at 3,000 yards. This is carried by the "Matsushima" class. The only better gun in the U. S. navy is the piece carried by the "Maine" class, but the 13-inch of the "Alabama" is nearly equal to it.

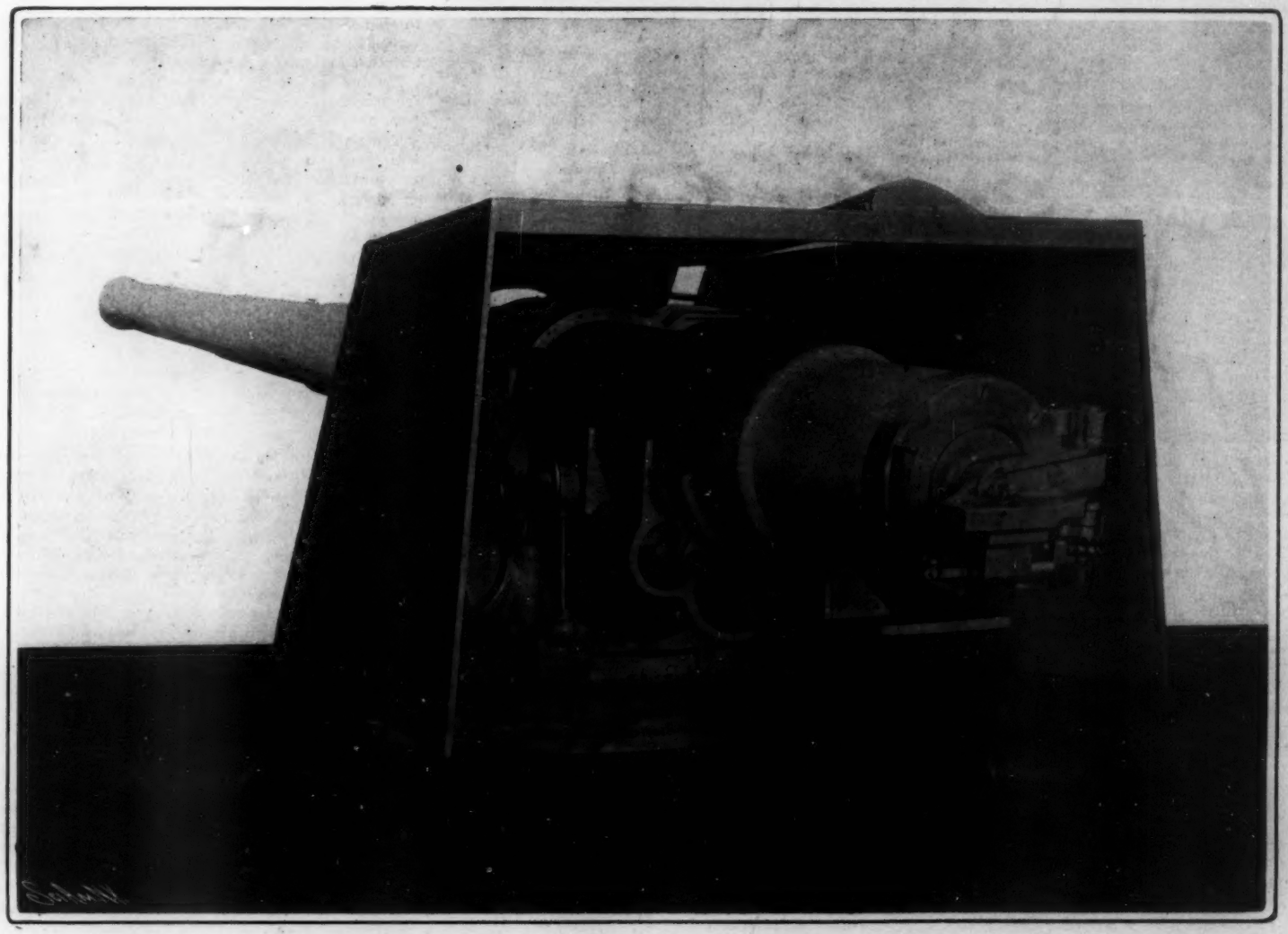
The "Kasuga" carried a powerful 10-inch of 45 calibers, with a velocity of 2,710 foot-seconds and 25,000 foot-tons odd muzzle energy. It is equal to the 35-caliber 12-inch gun of the Russian battleships. It is of Elswick pattern.

There are four old 12-inch Krupps in the "Chen



Length, 40 calibers. **Caliber,** 12 inches **Weight of shell,** 850 pounds. **Weight of gun,** 49 tons. **Muzzle velocity,** 2,423 foot-seconds. **Muzzle energy,** 34,600 foot-tons.

The Standard Battleship 12-inch Wire-Wound Gun.



Caliber, 8 inches. **Length,** 40 calibers. **Weight of shell,** 250 pounds. **Weight of gun,** 15½ tons. **Muzzle velocity,** 2,068 foot-seconds. **Muzzle energy,** 7,413 foot-tons.

The Standard 8-Inch Cruiser Wire-Wound Gun at Present Mounted on Japanese Cruisers.

JAPANESE NAVAL GUNS.

Yuen," but these are weak pieces, no better than the 8-inch in penetrative power. Some old Krupp 10-inch also exist, but they cannot penetrate more than a 6-inch plate of modern make.

Japanese ships have electric hoists and the Barr and Stroud range finders and transmitters.

The normal Japanese shooting is not very good, but of late immense pains have been taken with it, and considerable improvements have resulted.

The 3-inch rapid-fire gun, which enters so largely into the armament of Japanese ships, is shown in one of our illustrations. It is an Elswick gun, and the pattern that is at present in their navy is a 40-caliber piece, firing a 12-pound shell with a velocity of 2,200 foot-seconds, and an initial energy of 420 foot-tons. This gun, however, is made in 45 and 50 caliber lengths, and it is one of these that is shown in our illustration, mounted on a pedestal mount and protected by a shield.

The 3-inch rapid-fire field gun of the Vickers-Maxim make is a compact and efficient piece, which is used for landing purposes. The gun slides in a cradle provided with trunnions, which rest in trunnion bearings in the top part of the trail. The cradle is provided with two hydraulic buffers, in which work pistons attached to a projection on the under side of the breech of the gun. Inside the cylinders are strong springs, which cause the gun, after firing, to return to battery without any blow or rebound, and without causing any alteration to the elevation or training. It is this feature, coupled with the rapid action and simplified breech mechanism, that gives to this piece its rapid-fire qualities. The trail is fitted with a shoe and an eye for limbering up; and track shoes, shown in the illustrations, are attached by steel-wire ropes to the sides of the trail. The shoes, acting with the spade piece, at the rear end of the trail, which is driven into the ground, serve to prevent the recoil of the cartridge itself. At the extreme end of the trail is an eye for coupling up the gun at the limber.

An important element among the smaller naval guns is the Maxim rifle-caliber gun, which is mounted on the bridges and in the fighting tops, and is also provided with a combined carriage and tripod for landing purposes. The gun, as shown in our illustration, consists of two portions, the recoiling and the non-recoiling. The recoiling portion includes the barrel and the firing mechanism, which move to and fro upon guides attached to the frame, the energy of the recoil being taken up and regulated by means of a spring. The non-recoiling portion consists of the frame and the water jacket, which latter serves to cool off the barrel during firing. The gun is entirely automatic in its action, being fed with cartridges from a belt, and the firing is controlled at will by pressure applied to the trigger lever in the rear. The gun will fire at the rate of 600 shots a minute as long as any cartridges are left in the belt.

It will be seen that while the ballistics, as given above, of the Japanese guns at present mounted in their navy, are about up to the average, compared with the naval guns of other nations at present in service, they are below the ballistics of the latest types that are being mounted in the new ships of our own and other navies. As a matter of fact, the Japanese have suffered somewhat, in respect of the energy of their gun fire, from their intimate connection with the British gun makers, whose pieces, particularly those mounted during the past decade, in the British navy, have fallen sensibly behind the Krupp and Creusot artillery in velocities and energies.

The piece that will form the principal batteries in the new 16,400-ton battleships just ordered from Vickers-Maxim and Armstrong will be considerably more powerful than the present Japanese guns. Thus, the Elswick 12-inch piece of 50 calibers length weighs 65.2 tons, fires an 850-pound projectile with a muzzle velocity of 2,880 foot-seconds and muzzle energy of 48,000 foot-tons; and their 50-caliber 10-inch piece fires a 500-pound projectile with a muzzle velocity of 2,850 foot seconds, and a muzzle energy of 28,161 foot-tons. The ballistics of the new Vickers-Maxim guns are about the same as these. It is probable that the 50-caliber, 10-inch piece will be mounted in the two new battleships; but it is scarcely likely that the 50-caliber 12-inch gun will be used, the 45-caliber 12-inch being a more handy gun, although not so powerful. The latter piece weighs 58.5 tons, and fires an 850-pound projectile, with a velocity of 2,730 foot-seconds and an energy of 43,900 foot-tons.

Charles M. Stebbins, the pioneer of the telegraph west of the Mississippi, died recently in Berlin, at the age of seventy-five. In March, 1858, he purchased the St. Louis and Missouri telegraph line, which later became known as the Missouri and Western Telegraph Company. Mr. Stebbins threaded the West with telegraph wires. He constructed lines from St. Louis *via* Syracuse and Springfield, Mo., to Fort Smith, Ark., and from St. Louis, *via* Kansas City, Leavenworth, and Omaha, to Julesburg, Neb.

A NEW LIFE-SAVING GUN.

BY A. FREDERICK COLLINS.

The life-saving gun is absolutely indispensable to life savers at times when the surf runs so high as to prevent launching the lifeboat. In order to use the breeches buoy or lifecar, a line must first be shot to the vessel in distress. To insure success, the gun must load and fire quickly and accurately, for there is no time to be lost. This means further that the construction of the gun and the powder charge must be adapted to conditions of darkness, cold, and wet weather, which conditions are directly opposed to the successful working of the muzzle-loading gun, with its unprotected powder-charge bags, its open bore pointing skyward and closed at the lower end, forming a natural receptacle for water, and its open igniting primer and wooden carriage, which must be securely tied down to prevent recoil.

The disadvantages of such a gun were so overwhelmingly obvious to a young inventor, Mr. Francis G. Hall, that he decided to devise a gun which should embody a departure from the old methods. The improved life-saving gun is considerably less than three feet in length, and is built of steel and a special bronze alloy, which resists the action of salt air and water. The gun tapers from the breech, where the greatest strain comes, to a diameter of five inches at the muzzle. A special self-locking mechanism, at once the simplest and having the fewest working parts of any yet devised, closes the rear of the bore in such a way that any water finding its way into the gun will be

A NEW LIFE-SAVING GUN.

instantly drawn out. The firing hammer with its safety device is actuated by a lanyard, and relies wholly on the pull of the gunner, all the springs and delicate latches ordinarily used in army cannon being entirely eliminated. To prevent the troublesome and dangerous jumping back of the gun when fired, it is provided with simple liquid recoil checks attached to the trunnions, and operating very similarly to the common door check. Instead of having the powder charge in a loose woolen bag open to moisture, it is contained, together with its primer, in a hermetically-sealed bronze cartridge core, which slips easily into the breech of the gun. After the cartridge has been inserted and the breech closed, the projectile carrying the line is inserted in the muzzle and shoved home. This projectile is a cylindrical shot, rounded elliptically at the inner end and having means for securing the shot line at the outer end.

For shore use the Hall gun is supplied with a beach carriage of light but strong construction, with wide-tired wheels and a pivot socket for the recoil mounting, so that the gun may be swiveled about as well as elevated without moving the carriage. The recoil mounting renders it unnecessary to secure the carriage, a difficult problem on a sandy beach. A winding apparatus is provided for recoiling the shot line after use, and together with a cleaning rod and cartridge core completes the equipment. Revenue cutters, lighthouse tenders, fisheries vessels, and government tugs oftentimes render more effective aid to disabled ships than can be had from land, since wrecks frequently occur well offshore.

For this service the gun is provided with a light steel stand or tripod, as shown in the illustration, instead of the usual carriage; the tripod may be secured instantly as required in any one of several fixed positions on the vessel's deck. The United States government is at present equipping a number of vessels with this latter type of gun.

SOME UNUSUAL USES FOR FIRE-ENGINES.

(*Continued from page 10.*)

with a solution of lime, covering every branch and twig. An acre of tea is worth about $90, but a bad blight will reduce this by thirty per cent. The all-round cost of spraying tea plants with the fire-engine works out at about $1.25 an acre.

Another remarkable use for the fire-engine in agricultural England is sheep-washing, which may be seen in progress on the estate of Mr. A. H. Tarleton at Uxbridge, about fifteen miles from London. Here a little steam fire-engine throws one hundred gallons a minute onto the fleece of each animal; and even horses are treated in a similar manner.

Sewer flushing is very extensively done in England by means of the fire-engine, which does its work in one-tenth of the time occupied in ordinary flushing. With a rose nozzle on the hose, and a full head of steam on, a tremendous force of water is exerted on the walls of the sewer, which are washed absolutely clean, so that the deadly sewer-gas cannot be formed.

The flusher consists of a cylinder with small nozzles, or perforators, so arranged that the water under pressure radiates in all directions. The flusher can be drawn through the sewer from one manhole to the next by means of a rope, the hose being paid out from the surface as the flusher travels forward. This apparatus will cleanse about eight hundred feet of sewer a day at a cost, including labor and water, of about $15; whereas to do the same work less efficiently in the old way, including labor and cartage of water, would take eight days, and cost over $125. Moreover, sewer cleansing by fire engine would only use 6,000 gallons of water, as against about 50,000 required by the old method.

The fire-engine will also cleanse streets, but this is so well known to the general public, who have often watched the interesting operation, that further description beyond mere mention is almost superfluous.

Nothing but leather hose can be used satisfactorily for street cleaning, as all fabric and rubber hoses have a much shorter life in this work than leather.

The propulsion of boats by fire-engines is more or less familiar to our readers, the jet of water being thrown into the air and acting precisely as a punt pole pressed against the bottom of a shallow stream. Some floating fire-engines were recently sent out from London to Alexandria in Egypt for work on very shallow canals, and these craft depended entirely upon the handling and maneuvering of the jets of water for their propulsion.

In some of the country mansions of England fire-engines are kept, which can be driven by the ordinary electric-lighting current when desired at a critical moment; or the fire-engine will wash the outside of the windows without endangering the lives of servants.

The Death of Charles B. Scott.

Mr. Charles B. Scott, a well-known geologist, died at his home in Plainfield, N. J., on June 20. A graduate of Rutgers and of the University of Michigan, he was for a time connected with the Geological Survey of New Jersey. He became professor of science in the high school at St. Paul. Abandoning this position, he began work at the State Normal School, Oswego, N. Y. In 1889 he was sent by the American Missionary Association to Porto Rico, in order to advance the educational interests of that island. For three years he worked there. At the end of that time he became superintendent of schools of the American Missionary Association in Savannah. Latterly Prof. Scott was engaged in biological work at Hyannis, Mass.

Arrival of the Turbine Yacht "Lorena."

Mr. A. L. Barber's English-built turbine yacht "Lorena," which has been fully described and illustrated in these columns, arrived in New York harbor June 20. She had steamed from Falmouth on the 28th of May, but was compelled to put into Halifax in order to replenish her coal supply. The "Lorena" encountered exceptionally bad weather, head winds and seas almost all the way. One man was lost. It was largely due to the heavy seas that the "Lorena" was unable to make anything like a turbine transatlantic record. Her daily runs in knots are the following: 265, 331, 297, 245, 96, 224, 226, 260, 324, and 384.

An Automobile Record from Boston to New York.

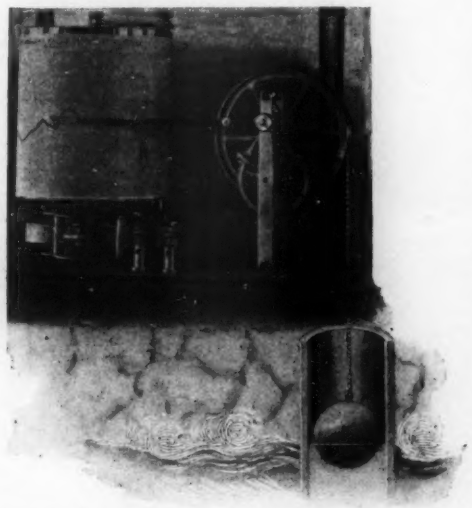
Henry S. Harkness, on Sunday, June 19, covered the distance from Boston to New York, 243.7 miles, in 6 hours and 55 minutes. The time made compares favorably with that of the fastest express trains, and is the best ever made by an automobile on the road in America. At times Harkness claims to have made as much as 83 miles an hour.

A USEFUL INSTRUMENT IN THE NIAGARA FALLS POWER HOUSE.

BY ARTHUR D. WEEKS.

At the great power plant at Niagara Falls, New York, an accurate record of the depth of the water both in the forebays and in the immense underground tunnel must be constantly at hand. The depth of the water varies, with a high east wind, as much as three feet; and these winds always bring about an extra rush of grass in its season, which finds its way to the racks before each forebay. This grass would in an exceedingly short time, if not removed, cause the disabling of one or more dynamos, by ruining their thrust bearings.

The instrument herewith illustrated is a useful and valuable one, showing at a glance the height of water in the forebay. A cord is passed once around the large wheel at the right, which is grooved to hold it in place, one end being secured to the wheel, while the other is attached to a float. This float is usually contained in a large pipe, in order to prevent injury to the same. When the float rests upon the water, the needle is adjusted to the measured depth of the water, and is then set. A coiled spring assists in the return, and steadiness of the needle. The scale on the chart is properly proportioned for time and height of water. It takes considerable wheel travel to make much variation in the needle movement. Two binding posts are shown, which admit of connecting in a battery and bell, with contacts designed so that the alarm bell rings when the water has gone down to the danger mark. If used on a tank service, this would be a signal to start the pump, if the pump did not work automatically. When, as frequently happens, the water is dangerously low, men are at once set to work to rake away the grass from the racks before the forebay is affected. The recording device also makes a continuous record for twenty-four hours, when the



AN INGENIOUS WATER GAGE IN USE AT NIAGARA.

chart is removed and placed on file, and a fresh one substituted. These chart records serve their purpose well, furnishing a complete and accurate reference for consultation at any future time, should it be desired to obtain knowledge of conditions prevailing at any stated period.

A bearing of the 5,000 horse-power generators would be burnt out if the water were allowed to become too low in the forebay, at which time the pressure of the revolving parts is downward. A bearing would be ruined also if the oil supply were accidentally stopped, or not turned on when the generator was started. The water gage shows whether the trouble is due to low water or to other conditions.

Down in the immense tunnel beneath, where the water dashes in wild fury as it is lashed about in its exit from the huge turbines, this measuring instrument is of great value. The depth of water in the tunnel is closely watched with each increase of power, this meaning more or less increase in height of water in the tunnel. Any back pressure from the water, caused by its rising above the turbines, would of course mean a loss of power at the dynamo.

During the winter and late into the spring, in the time of running ice, and while the troublesome anchor ice is forming, the chart proves its inestimable value. Anchor ice forms very quickly, and the men are constantly on the alert to detect its formation, when the racks must be at once removed, lest their openings freeze over, thereby cutting off the water supply to the turbines and destroying their thrust bearings. The chart indicates at all times the exact conditions prevailing.

The United States government has a number of these valuable instruments in use at Erie, Buffalo, and elsewhere. The device is the invention of Joseph Wills, master mechanic of the Niagara Falls Company.

INSULATING APPARATUS FOR CANNED GOODS TO PREVENT PTOMAINE POISONING.

Now that preserved tinned or canned foods, such as meat, fish, fruits, and other comestibles, constitute such an important factor of commerce, it has become imperative that the contents should be protected from any organic or chemical action that may be set up, either through the contact of the edibles with the metal of the tin, or the solder with which the lid and can, when filled, are sealed. Indeed, the liability of ptomaine poisoning arising from many of these causes constitutes one of the gravest dangers of the tinned preservative, and is one of the most difficult problems that has to be surmounted. Many devices have been contrived to secure this desideratum, but they have proved only partially successful.

An ingenious invention has, however, now been devised, by which all possibility of the preserved contents coming into contact with the metal lining of the tin has been entirely and successfully overcome. The apparatus is the idea of Mr. James Dowling, of London, and has already been adopted by one of the most prominent canning firms of Great Britain.

The principle of this contrivance is that a lining of parchment—this substance is preferable, as it is impervious to any of the liquid exuding from the preserved comestible—paper, or some such similar material is fashioned, in which the article of food is placed. By this means it is impossible for the edible to come into contact with the tin at any part, and therefore all possibility of ptomaine poisoning from this cause is absolutely obviated.

As may be seen from the accompanying illustration, the apparatus is of simple design and operation, so that it can be manipulated by a boy, girl, or an unskilled workman. The apparatus comprises four cardinal features, as follows: A solid shaped plunger or block, slotted and fitted to a vertical slide for the accommodation of expanding and receding pleating blades; a guide tube, for holding the material to be shaped in position; a metal plate grooved to correspond with the pleat-forming blades, for the passing of the material to be shaped or formed; a metal cylinder slotted vertically, for the reception of the pleated material. This cylinder rises vertically, and by a rotary movement releases the pleats from the slots, while the same movement presses the formed pleats, and completes the shaping of the insulating linings.

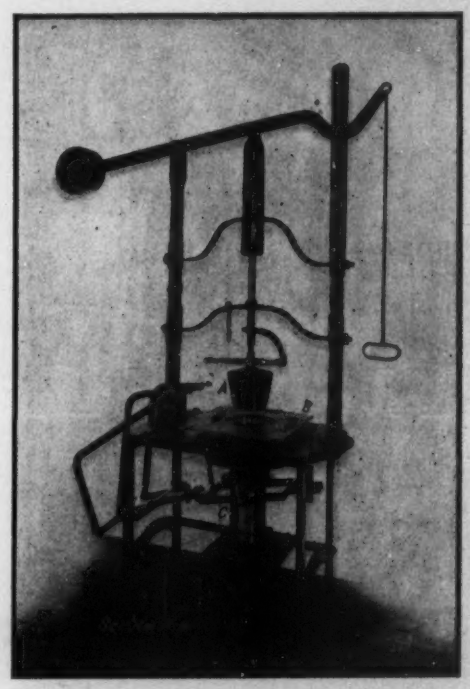
There are two plates fitted to a table, forming a rigid part of the machine, each of which has a central hole, the diameter of which is slightly less than that of the tin it is to fit. These two plates are hinged at the rear. The operator lifts the upper plate in the same manner as if it were the lid of a box, and then slides the sheet of parchment or whatever material is used over the hole in the lower plate. This sheet has been previously cut into circular form, and there is a circular guide to carry it in the proper position upon the lower plate. By this means the hole in the latter is bound to be centrally placed below the center of the disk of parchment. The upper plate is then closed down flat in its normal position upon the sheet of parchment. In order, however, to prevent the plates holding the paper too tightly, the upper one is provided on its under surface with a number of radial ribs, while all around the hole in the lower plate are a number of projections and recesses, conforming to the shape and the depth respectively of the blades on the plunger or die.

When the parchment has thus been inserted and closed down, the plunger is forced down upon it by means of a lever controlled by a handle. This plunger constitutes an important part of the mechanism. It consists of a disk with a number of radial blades pivoted to it on a sleeve. This latter mechanism is made detachable, so that a die of any desired pattern may be fitted if necessary. The plunger forces the parchment through the plate shaped to carry the radial blades of the plunger. Below this plate is a cylinder, which is slotted in a manner corresponding to the pattern of the die. This tube or cylindrical folder, as it is called, is brought into operation with another lever. As it rises, it rotates, and the plunger rises also, releasing the lining a little. The folder in its action folds over the pleats of the parchment formed by the plunger striking it. The machine relapses back into its normal position by means of counterbalance weights, and the finished shaped lining is withdrawn.

The finished insulating lining is slightly deeper than the tin into which it is intended to be inserted. Furthermore, there is the top to be fitted. This latter operation is accomplished upon the tinning machine. The lining is placed in the machine together with its edible contents. The top lining comprises a circular disk of parchment, which is cut the same size as the top of the tin. The lid is not attached by means of solder, but it is "spun" on. This operation is accomplished as follows: The tin with its contents is placed in the canning apparatus. The disk of parchment is then placed over it, and then the lid of the tin. A sharp rotary movement is imparted to the tin, and at the same time pressure is applied to the lid. This forces down the projecting rim of the parchment lining, and this edge, together with the edge of the top disk and the tin lid, are spun into the form of a beaded edge right round the top of the tin, thus sealing it, and rendering it absolutely air-tight.

When the tin is opened, the insulating lining is removed with the preservative within, and turned out upon a dish. The provision of this insulating lining not only acts as a preservative safeguard against the comestible touching the metal of the can, but also enables the contents to be withdrawn with perfect ease, and served with a more appetizing appearance.

This ingenious machine enables the insulating linings to be turned out quickly and cheaply. Although the provision of such linings has long been recognized as the best possible solution of the ptomaine poisoning difficulty, yet it has not been widely adopted, owing to the high cost of preparing the linings by hand. One operator, even when extremely dexterous, can only produce one lining in about six minutes. With this machine one operator, however, can fashion ten linings per minute, or about 600 per hour. In a practical test it has been ascertained that one operator with this machine can manufacture the same number of linings in a working week as sixty operators working the same number of hours can shape by hand. The actual cost of manufacture is very small, including the



A. Plunger. *B*. Plates between which paper is placed. *C*. Cylindrical folder, which folds over the pleats made by the plunger.

INSULATING LINING APPARATUS FOR TINNED FOODS TO PREVENT PTOMAINE POISONING.

cost of the material, and does not increase the cost of preparing a tin of food to any appreciable extent. It is hoped in England that, owing to the frequency of ptomaine poisoning cases, it will become compulsory to provide the tins with some such linings as are made by this machine, in which event it will have a great future.

The Current Supplement.

The current SUPPLEMENT, No. 1487, opens with an illustrated description of the power plant of the city of Geneva, written by the Paris correspondent of the SCIENTIFIC AMERICAN. Prof. Storm Bull recently read before the Western Society of Engineers, an exhaustive paper on superheated steam in which he reviewed its development and use. The paper is published in full in the current SUPPLEMENT. The experiments of Emile Guarini in using the earth as a return conductor for commercial electric installations are fully described. Mr. W. H. Holmes presents an interesting account of the shell ornaments from Kentucky and Mexico. "Improved Methods of Producing Color Values for Monochrome and Three Color Printing" is the title of an article by Mr. John Carbutt. An inquiry into the working of the various water softeners was recently conducted by Messrs. C. E. Stromeyer and W. B. Baron. The results of that inquiry are published. The English correspondent of the SCIENTIFIC AMERICAN describes a machine for measuring screw threads, installed at the National Physical Laboratory in Great Britain. In an article entitled "Some Novel Phenomena in Connection with N-Rays," convincing photographic proof is given of the existence of these radiations.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRICAL TEMPERATURE-ALARM.—J. P. Bolton, Fresno, Cal. Frosts cause incalculable damage to orchards and vineyards and as an adjunct to various methods of frost-fighting Mr. Bolton has devised a novel alarm in the nature of an attachment to the ordinary dial-thermometer which is designed to be set up in an orchard or vineyard and wired into a sleeping-apartment or any desired point and then connected to a bell to be rung whenever the temperature falls to the danger point.

ELECTRIC MUSICAL INSTRUMENT.—E. A. Fetching, Lymansville, R. I. In using this invention, the operator grasps a sprinkler and apparently waters the various flower-pots, but really brings contact member into engagement with various contacts, thereby completing circuit through the bell and circuit through electric lights on approaching a flower-pot. Though having the appearance of a gardener watering flowers he causes each of the pot-bells to sound at will, and simultaneously three electric lights glow, illuminating flowers and attracting attention of the audience to the pot the sound proceeds from. Any tune desired can thus be played by the operator.

Of Interest to Farmers.

THRESHING-MACHINE.—M. Davis, Ames, Oklahoma Ter. This machine is simple in construction and has great capacity. The concave and cylinder usually employed are entirely dispensed with. Through the medium of the drums and a separator a quick and thorough separation of the chaff and straw from the grain is obtained and the grain conveyed from the machine expeditiously and without waste and the straw and chaff are automatically delivered from the machine through the stacker-tube, which has such movement that a stack of waste can be readily made.

PLOW.—C. F. Bates, Wellington, Kan. The invention is an improvement in listers or double-moldboard plows, which are particularly adapted for cultivating between standing rows of plants. The share has its sides at an angle to each other and at the front it is vertically slotted to adjustably receive a separate point, and the latter has an adjustable cutter at its under side which projects forwardly. The side edges of the share have reversible and extensible cutters.

BINDER ATTACHMENT.—H. J. Schwarze, Verona, Mo. In this patent the invention relates to an improved manner of mounting the check-springs of grain-binders, which are commonly arranged to bear on the binder-deck to retard the grain during the formation and binding of the gavel. The springs may be readily adjusted by the operator without leaving the harvester's seat. This enables the production of a properly-bound bundle irrespective of the condition of the grain, and it is well known that as the condition of the grain varies the check-springs must be adjusted accordingly.

SICKLE AND CUTTER-BAR FOR HARVESTERS.—J. D. Teeters, W. J. Teeters, and Willis J. Teeters, Newton, Neb. One purpose of the invention is to so mount the chain of sickle-knives upon the cutter-bar as not to interfere with raising and lowering the bar as desired, and so that the forward and rear stretches of the chain of sickle-knives are maintained in approximately straight lines and in approximate parallelism, so that the forward stretch of the chain cannot move backward or upward or downward, insuring the knives during the cutting operation being positively held up to their work.

HARVESTER.—G. D. Luce, New Orleans, La. In this instance the invention relates to improvements in sugar-cane harvesters, an object being to provide a motor-operated machine of novel construction that may be employed for cutting cane for planting or windrowing purposes and that may be arranged for topping, stripping, and loading the cane when the cane is to be sent to the mill.

HAY-LOADING MACHINE.—S. Smith, Weede, Mont. The objects of this invention are to provide a machine thoroughly effective and reliable in operation, easily controlled in the field, possessing the capacity for long and repeated service, to overcome numerous disadvantages encountered in the use of like machines and for the ready propulsion of the apparatus over the field or surface from which the hay is to be gathered. The machine comprises elevator devices of special construction and operation, and is preferably propelled by means of a wagon or similar vehicle into which the hay is to be loaded.

Of General Interest.

SNAP-HOOK.—S. Smith, Weede, Mont. This hook comprises an ordinary shank and bill, and co-operating with the end of the bill is a movable yoke which is normally maintained in closed relation with the bill, thus preventing disengagement of the hook from any device to which it may be attached for fastening. A thumb-plate or lever is employed for operating the yoke to enable the application and release of the hook, the lever securely holding a part of the yoke in contact with the end of the bill. It is not liable to become clogged up in use.

CHEESE-GAGE.—W. H. Frank, Burkesville, Ky. This improved apparatus is adapted for use in slicing and selling cheese in different quantities and at different values and will greatly economize the time and labor of the grocer. It is not a necessity that cheese should be made up in elongated blocks rectangular in form, since the ordinary circular cheese may be cut up into sections or blocks of such form and proportions as will adapt them to be sliced by aid of this gage.

CLOTHES-LINE PIN.—J. W. Finch, Anguilla, Miss. In this patent the invention has reference to clothes-line pins; and it consists in a specially-constructed clothes-pin of novel form whereby the clothes may be secured to the line more effectively than possible with similar fastenings as they have heretofore been constructed. One advantage is the provision of a handle adapted to be grasped, so that the rolling action imparted to the pin is facilitated.

HAIR-PIN.—G. H. Bigelow, Honolulu, Hawaii Ter. Mr. Bigelow's invention consists of a hair-pin comprising side members, the upper end of the pin being curved or bent to form a finger-hold whereby ready removal of the hair-pin may be effected. It consists of a pin comprising side members united at the top, one side member being provided with an inward crimp and the other with an inward bend above or overlapping the crimp in the opposite member.

UPRIGHT BOILER.—N. L. Warren, Macon, Ga. In this patent the object of the invention is the provision of a new and improved upright boiler arranged to permit convenient entrance of the operator for cleaning the interior of the boiler and to give ready access to the smoke-tubes to clean the same.

MIXTURE FOR TREATING TUBERCULOSIS.—R. Schneider, Berlin, Germany. The object in this case is to provide an improved mixture for the successful treatment of tuberculous and catarrhal complaints in human beings and animals. The mixture consists, essentially, of a powder containing ingredients of eucalyptus, sulfur, and carbon. A few weeks at least is necessary for treatment of tuberculous complaints.

LACING-EYELET.—A. Fonts, New York, N. Y. The inventor particularly contemplates in this instance the provision of an eyelet which may be applied to a shoe in substitution of the lacing-hook commonly in use, his eyelet being so constructed that the lace may be readily and easily tightened and loosened, while at the same time it will not be cut, marred, or worn, as is the case with laces secured by the lacing-hooks referred to.

COMB.—A. Fonts, New York, N. Y. One of the disadvantages incident particularly to ladies' hair-combs now in use is that owing to their peculiar formation when in position in the hair the comb is liable to become loosened. The inventor therefore has in view as an object in this invention the provision of a device designed to be secured to the comb, whereby the comb will be clasped or held firmly in the hair, obviating the possibility of the comb becoming loose and falling from the hair.

CURTAIN-POLE.—J. Kroder, New York, N. Y. In this patent the invention relates to curtain-rods, curtain-poles, and similar fixtures; and its object is to provide a new and improved means for removably fastening the balls, knobs, or like devices to the ends of the pole, at the same time reinforcing or strengthening the balls, knobs, or like devices.

COKE-OVEN.—J. S. Maxwell, Cumberland, Md. In this case the invention relates to improvements in coke-ovens; and the purpose of the inventor is to provide an oven having more grate capacity than the usual round or "beehive" ovens occupying practically the same space. A further purpose is to so construct the oven that repairs may be made at small expense, and the most important improvement in the oven is the straight arch, as by such arch repairs on the arch are saved.

PROCESS OF MAKING ACHROO-DEXTRIN.—G. Reynaud, 5 Rue Salneuve, Paris, France. In this invention the process for treating acid peats for the industrial manufacture of achroo-dextrin, consists in mixing the peat to be treated in three to five times its weight of water and heating this mass under a low pressure in a digester, to a temperature of 110 deg. to 150 deg. Centigrade during half an hour to an hour, according to the degree of acidity of the peat, for the purpose of converting the amylaceous matters of peat into achroo-dextrin. A process for treatment of peat was allowed Mr. Reynaud in a former patent.

EYEGLASS-GUARD.—W. H. Wilson, New York, N. Y. By means of this improvement the inventor provides a soft and durable guard and one which is much easier on the wearer than the cork and tortoise-shell guards now commonly employed, for the chamois-skin has the peculiar tendency to stick or adhere to the skin of the wearer, and owing to this the eyeglass equipped with the invention will be securely held in place by less pressure than ordinarily employed.

DEVICE FOR FASTENING, ADJUSTING, AND LOCKING WINDOW-SASHES.—A. H. W. Wedler, 141 Rundle Street, Adelaide, South Australia, Australia. Means are afforded in this case for fastening and locking sashes of windows when closed and also when adjusted with an opening at top or bottom or both top and bottom. An essential feature is the construction of the piston-head and combination therewith of the spring and cam whereby an automatic fastening action is attained. The main portion of the appliance is cast in brass or other approved metal. The piston head is constituted of hardened steel.

MATCH-BOX.—E. C. Carris, Washington, Iowa. The intention in this case is to provide novel details of construction for a device which adapt the box to mechanically elevate a single match from a number in the receptacle and retain it at a selected point in the box for removal, the mechanism being arrested by the elevated match and operating for the lifting of another match only when the one held is removed.

MAGAZINE FILM-HOLDER.—W. F. Folmer, New York, N. Y. The purpose in this improvement is to provide a holder for cameras constructed to hold cut films in predetermined quantities and a shutter for the holder which when opened exposes the front film and which when closed forces the exposed film and its carrier into a bag connected with the body of the holder, wherein a film and its carrier can be readily manipulated for location at the back of the mass of unexposed or previously exposed films in the holder.

RETORT.—H. Hirsh, Eastman, Ga. Mr. Hirsh's invention relates to retorts, and more particularly to a form of retort suitable for the destructive distillation of coniferous wood—such, for instance, as southern pine, or so-called fat-pine. A feature of great importance is the turpentine vapor pipe. By its use turpentine is produced comparatively pure. Less volatile products—such as tar, resin, and acids—are not driven off during the time the pipe is in use and are therefore condensed by a general vapor-pipe only.

MOLD FOR CONCRETE WALLS.—P. H. Clingan, Florence, Col. In carrying out the present invention the inventor provides an improved mold which renders it possible to form the wyeths or partitions of alternate courses directly over each other, thereby forming continuous air flues or chambers. He provides an inner casing forming a portion of his molding apparatus, said casing being removable from one portion of a course of the wall to another, said casing being provided with mechanism for expanding and contracting the wall or body of the same. In conjunction with the inner casing he uses an outer, which molds the wall either plain or in imitation of other masonry.

FEED-BAG.—W. Cook, New York, N. Y. The invention refers to improvements in feed-bags for attachment to horses' heads while feeding, and the object is to provide a bag the contents of which are prevented from spilling while the horse is feeding and which has sanitary advantages that prevent disease and afford ventilation.

Hardware.

NUT-LOCK.—E. C. Blackburn, Aspen, Col. In this instance the improvement is particularly in nut-locks having pawl-plates and movably connected with the nut so they will rock into engagement with the abutment and lock the nut when the latter is turned home, the invention being especially designed, by reason of its cheapness and simplicity, for use on automobile-frames, locomotive-frames, structural iron-work, farming machinery, etc.

Heating and Lighting.

STEAM RANGE.—H. J. Bishop, Jersey City Heights, N. J. Mr. Bishop's invention relates to improvements in steam ranges especially designed for cooking and domestic purposes; and his object is to produce a simple and inexpensive structure wherein provision is made for heating by steam an oven-chamber and a plurality of cooking vessels, the supply to the several parts being controlled at will. A further object is to provide means for confining a removable vessel in steam-tight relation to a steam jacket which constitutes a permanent fixture of the structure, the vessel being so disposed as to permit access to be obtained easily to the contents without disturbing the relation of the vessel to the jacket.

OIL-BURNER.—O. Hauck, Newport News, Va. It is the object of this invention to provide an oil burner and heater for the use of brazers in soldering the surface of copper and other metal and also for burning off paint and other allied uses. The invention includes improvements in the construction of the body of the heater or burner and attachments thereof and also in the construction of the air and oil feed devices constituting the burner proper.

Hydraulics.

HYDRAULIC PRESS.—E. Crowe, Birchholm, Bushey Wood, Totley Rise, Sheffield, England. The object in Mr. Crowe's invention is to effect economy of time and power, and so increase the speed of working and the efficiency of the press. This is attained mainly by means whereby the idle descent of the press-head onto its work may be effected quickly and by gravity alone and whereby the power of the pumps is caused to come into action automatically immediately the tool carried by the press-head encounters the work.

Machines and Mechanical Devices.

ENVELOP-SEALING MACHINE.—C. J. Fancher, West Granby, Conn. The machine embodies a stack or bopper, across the bottom of which operates a slide which engages under the sealing-flap of envelop and draws the envelop out of the stack. The slide carries a moistening-brush operated upon the movement of slide to wipe over the previously-gummed flap, and said brush operating on the flap moves it against a spring-pressed backing plate, insuring proper engagement between flap and brush. Then continued movement of slide projects the envelop between one or more pairs of rolls, which press the flap into position on the envelop and finish the sealing.

VARIABLE-SPEED TRANSMISSION AND REGULATOR OR BRAKE.—C. Hibbard, W. Hibbard, and S. Hibbard, Sandyhill, New York. The object of the inventors is to provide a brake for use on automobiles and other machinery, and arranged to insure an easy transmission of the power of the motor to the shaft to be driven without shock or jar, to permit the operator to quickly reverse and use the device as a brake, and to enable him to vary the speed of the driven shaft independent of the speed of the motor, and to allow stopping the driven shaft without stopping the motor.

BALL-WINDING MACHINE.—P. Ryan, New York, N. Y. In this patent the invention has reference to a ball-winding machine; and the object that Mr. Ryan has in view is the provision of means by which a winding of yarn or equivalent material may be applied uniformly to a core to produce a spherical article, the latter being adapted for use as a base-ball.

PUPPET-VALVE AND SUPPORT THEREFOR.—B. Morgan, Rhinebeck, N. Y. The aim of this invention is to provide details of construction for a puppet-valve and also for the supporting-cage that carries the valve-seat which adapt the improved valve for very reliable service, reduce wear and necessary repair to a minimum, and afford a simple, practical device that is adapted for service either as a relief-valve or a feed-valve for steam, water, or gas used as a motive agent for stationary or automobile motors.

BULL-WHEEL FOR REVOLVING DERRICKS.—A. Lambert, Newark, N. J. One object of this invention is the provision of a construction of a wheel wherein a number of channeled-iron members are assembled and united in a manner to secure maximum strength and rigidity. Another is to provide an arrangement of braces for solidly holding the several members in proper relation, and, furthermore, to provide means for rigidly fastening to the wheel the foot-piece required for stepping the mast and for the pivotal support of the boom.

BAND SAWING-MACHINE.—C. Seymour, Defiance, Ohio. The machine gives the proper tension to the saw-band to allow the latter to yield in case the cutting edge strikes a knot or the like in the work, thus preventing injury to the saw-band and other parts, the arrangement also permitting of placing the saw-band quickly in position on the wheels or removing it therefrom for sharpening the band or replacing it by another.

CLAMPING DEVICE.—C. Seymour, Defiance, Ohio. The object in this case is to provide a device for a rack-and-pinion movement arranged to allow the operator to conveniently turn the pinion to move the rack-bar to a desired position and to permit of locking the pinion, and consequently the rack-bar, against movement whenever the rack-bar has been removed to the desired position. This improvement is a division of the application for Letters Patent of the United States for a band-saw, formerly filed by Mr. Seymour.

CLEARER FOR RING-SPINNING FRAMES.—W. H. Gordon, Fall River, Mass. The present invention resides in peculiar hinging means adapting the clearing-board to be lifted for inspection and cleaning, which means shall not only support the clearer-board at turned-up position, but be adapted for attachment to any type of drawing-roll support now commonly used on ring-spinning frames. The invention relates to that class of devices which are designed to keep the top rolls on ring-spinning frames free from "fly" and dirt. The object is to provide means obviating removal or detachment of the board from the roll-stand or other means of support.

BUMPING-SCREEN.—H. L. King, Denver, Col. The present invention is in the nature of certain improvements upon the bumping-screens for assorting ores which was formerly patented by Mr. King. It consists in the construction and arrangement of the tappet mechanism for vibrating the screen-frame and in the combination of the same with the screen and its accessory parts. The mechanism for vibrating the screen in the former patent consisted of a wiper-cam.

CROSS-TIE HEWER AND VENEER-MILL.—B. H. Seymour, Ocala, Fla. In this patent the invention is an improvement in woodworking machines, and especially in machines of the nature of cross-tie hewers and veneer-mills, whereby the ties may be readily brought to the desired shape or veneers can be cut as may be desired. A great advantage is in the independent feed mechanism, which rapidly retracts as well as secures a rapid advance movement of the carriage when desired.

Pertaining to Vehicles.

HUB OR WHEEL MOUNT.—J. J. McNulty, Carmel, N. Y. The invention lies in

the provision of a tubular axle for the hub and in the peculiar combination with this axle of a tie rod or bolt which is passed through the tubular axle and through the fork or other part of the vehicle-frame on which the wheel is mounted. By this arrangement upon taking out the tie-rod the wheel may be readily removed from the fork without danger of displacing any of the bearing-balls or other parts of the structure, excepting of course, the tie-rod.

Railways and Their Accessories.

CAR-FENDER.—O. THIBAULT, Fall River, Mass. The intention in this instance is to provide a new and improved car-fender arranged to readily follow the curvature of the track to insure picking up of persons or other obstacles in the path of the car at all times without danger or unduly injuring the person or other obstacles.

COMBINED STOCK, COAL, AND COKE CAR.—G. E. SIMONTON, Vanwert, Ohio. The object of this invention is to provide a metallic structure which may be used to transport live stock in one direction over a railroad and thereafter converted into a car adapted to carry coal, coke, ballast, or other material when reshipping the car, thus making the car useful in transporting freight any direction and increasing the earning capacity of the car by obviating the return of the same in an empty condition.

RAIL-CLEANER.—P. C. HUNTER and W. C. BAMBER, New York, N. Y. In this patent the invention relates to improvements in devices for cleaning snow, ice, and the like from the "third" rails or other electricity-conducting rails in electric-railway systems, the object being to provide a device that shall be simple in construction and that may be readily applied to cars of existing types.

DEVICE FOR PLACING RAILWAY-TORPEDOES.—E. M. JONES, Enid, Oklahoma Ter. By means of this invention a person on a train may place one or a number of torpedoes successively on the rails without stopping the movement of the train. The device is hand-operated entirely, and being light and simple, it may be handled with facility by the trainmen.

NUT-LOCK.—A. M. WILSON, Cherokee, Iowa. Briefly stated, this invention relates to a nut-lock especially adapted for use at rail-joints and in analogous structures where two nuts are adjacent to each other and to devices of that class in which a connecting piece or shank extends between the two nuts, each end of the shank carrying a lock proper working with the respective nuts.

SAND-CLEANING APPARATUS.—W. S. VANZANT, Eldredge, N. J. In carrying out the present invention Mr. Vanzant contemplates the provision of an apparatus which will produce filter-sand of the proper grade, such sand being thoroughly tested and washed in its passage through the apparatus, and he has particularly in view so constructing the apparatus that sand may be taken from the sand-bank and passed to a car or bin without delay.

Prime Movers and Their Accessories.

GOVERNOR FOR MARINE ENGINES.—J. MATTHIESEN, 56 Wendelstadtstrasse, Darmstadt, Germany. The object in this invention is to provide a device for preventing racing when the propeller leaves the water or upon the breaking of the shaft or the like. It consists in the closing of the throttle-valve as soon as the engines, from one or other of the causes mentioned, exceed a predetermined maximum velocity. The valve is re-opened as soon as the engines have resumed their normal speed. The displacement of the valve is effected by means of a rod connected with the ship's engines.

SAFETY SPARK-SHIFTING DEVICE FOR EXPLOSIVE-ENGINES.—R. B. HAIN, Los Angeles, Cal. The invention comprises the combination, with the shaft of an explosive-engine and a shiftable electrical circuit-breaker and a sparking device connected with the latter, of a cover for the end of the shaft, a rocking journal for the cover having a radial arm, and a link pivotally connecting such journal-arm with the circuit-breaker, whereby upon raising the cover, the circuit-breaker is shifted correspondingly.

Designs.

DESIGN FOR A HANDLE FOR MIRRORS, BRUSHES, OR LIKE TOILET ARTICLES.—S. A. KELLER, New York, N. Y. This highly ornamental design for a handle, comprises a woman's head posed at the upper part of the handle, a handle narrowing then swelling then coming to a point at the lower end in graceful lines, the handle beautifully scrolled and flowered.

DESIGN FOR A BADGE.—J. S. MALLERY, Grants Pass, Ore. This ornamental design for a badge is neat and simple, and consists of a bird's web-foot and a well curved shield covering the heel or upper part of the foot, with a claw projecting slightly from one side of the shield.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 5677.—For manufacturers of electric fans which run with a dry battery.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 5678.—For the manufacturers of the "Ever-ready" electrical goods.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 5679.—For makers of electric motors with attachment of emery wheels and polishers.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5680.—For makers of tinfoil for wrapping moist goods, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 19 South Canal Street, Chicago.

Inquiry No. 5681.—For makers of gas traction engines.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5682.—For the makers of a cigar called "Good Health Cigar."

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5683.—For a large quantity of screws, cold rolled thread, having flat bottom, with slot on top, either flat or round; all to be about 3-8 inch or 5-16 inch and from 3/4 to 9 inches long.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5684.—For makers of vending machines, also makers of fire extinguishers.

WANTED.—Exclusive sale improved automobile specialties. Specialties, Box 773, New York.

Inquiry No. 5685.—For makers of artificial ice machines, also for plant erectors.

Wanted, agency or right for any good-selling specialty or machine. Best reference. W. C. Linehan, Cincinnati, Ohio.

Inquiry No. 5686.—For the makers of the stamping machine, for stamping on aluminium, called the "Simplex."

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 340 Cutler Building, Rochester, New York.

Inquiry No. 5687.—For makers of an ice cream freezer consisting of 6 or 8 individual cylinders.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5688.—For makers of tattooing machines, also supplies for tattooing.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5689.—For hand pumps capable of use to 40 pounds pressure, for air receiver.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 63 Canal Street, Chicago.

Inquiry No. 5690.—For a good, serviceable, light-draft boat about 20 feet long, for use on the Mississippi River.

Inquiry No. 5691.—Wanted, a practical garbage crematory.

Inquiry No. 5692.—For manufacturers of the Haunted Swing.

Inquiry No. 5693.—For manufacturers of porous stones or material suitable for filtering water.

Inquiry No. 5694.—Wanted, refined kerosene in cases and barrels of 62 gallons, for export.

Inquiry No. 5695.—For manufacturers of mechanical toys.

Inquiry No. 5696.—For firms desiring pattern work, in quantities, at cost. Derby's Pattern and Model Works, Perth Amboy, New Jersey.

Inquiry No. 5697.—For parties to manufacture several dental devices, including forceps.

Inquiry No. 5698.—For manufacturers of lawn clippers or mowers other than rotary or Beal mowers.

Inquiry No. 5699.—For the manufacturers of the "Crown Corking Machines."

Inquiry No. 5700.—For the manufacturers of the Lyman Boat, which is a round tub shape, made of rubber, with heavy rubber legs and feet, designed for sportsmen's use, and so constructed that one can sit in it and paddle around by means of his feet.

Inquiry No. 5701.—For manufacturers of wool-scouring machinery.

Inquiry No. 5702.—For manufacturers of a stamp and envelope moistener, made of sheet iron or tin.

Inquiry No. 5703.—For manufacturers of patented fodder forks on contract, made of cast steel.

Inquiry No. 5704.—For a machine that will rivet both ends of a bar at once, one inch apart.

Inquiry No. 5705.—For makers of furnaces for smelting lead, tin and Babbitt dross.

Inquiry No. 5706.—For a small canning outfit.

Inquiry No. 5707.—For machinery to manufacture handkerchiefs by weaving.

Inquiry No. 5708.—For Machinery to cut, hem, etc., cotton or linen cloth into handkerchiefs.

Inquiry No. 5709.—For apparatus to weave, cut and hem handkerchiefs when made from piece.

Inquiry No. 5710.—For the manufacturers of the International typewriter.

Inquiry No. 5711.—For makers of the vacuum disc or suction shoe for walking upside down on the ceiling.

Inquiry No. 5712.—For a toy balloon for experimenting.

Inquiry No. 5713.—For makers of board suitable for playing cards.

Inquiry No. 5714.—For machinery for making paper and straw board from straw.

Inquiry No. 5715.—For makers of machinery for making towels.

Inquiry No. 5716.—For machines for cutting tobacco leaves, green or dry.

Inquiry No. 5717.—For makers of a machine for breaking cocoanuts and removing the kernel.

Inquiry No. 5718.—For manufacturers of ice-making machinery for family use.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9414) T. L. asks: Does the output of a dynamo armature depend upon the number of turns of wire about the core or upon the amount of wire traversing space between the core and pole-piece? Is the purpose of the iron in armature merely to attract across it the lines of force through which the wire moves? Is it true that in ring armatures the wire on the inside is of no use except to conduct the current generated upon the outside? If so, why? Could the wire be arranged between armature core and the pole-piece in coils so that all the wire will generate current and so that the current induced in one turn of wire would counteract that of the next? A. The output of a dynamo depends upon all the elements of its design, and not simply upon the two which you name. The number of lines of force cut per second determines the volts; the size of the wire determines the amperes. The iron of the armature core is to furnish a path of low magnetic resistance for the lines of force from one pole piece to the other. The wire in the inside of a ring armature is of no use except as a conductor. The turns cut the lines of force in the opposite directions to those on the outside and cannot assist these in producing an electromotive force. A drum armature has all its wire active and of service in generating electricity.

(9415) M. P. C. says: Please answer the following questions: 1. In regard to the gas blowpipe described in "Experimental Science," what should be the diameter and length of the outside tube? What is the size of the hole in the end of the large tube? What is the inside diameter of the small or inside tube? Is it necessary to have the end of this tube contracted 0.05 of an inch? A. The length and diameter of the outside tube in the gas blowpipe is of little consequence. A half inch will be ample to admit the necessary gas. The hole in the end of the larger tube is a quarter inch, as is stated in the description in the book. The small tube may be 1/4 inch, with a tip whose opening is 0.05, as given. You should have a tip, since you cannot get a tube fine enough without a tip, and if you could it would soon clog with dust. 2. Can all the flames required for amateur glass blowing be produced with this blowpipe? A. The flame of this blowpipe is adapted to small jobs of glass blowing, as is stated in the book. We are not able to add anything to Mr. Hopkins's work. 3. Can acetylene gas be used in this blowpipe, and will the generator described in "Experimental Science" produce the gas fast enough? A. Acetylene can be used in place of street gas if you wish, and the generator described in "Experimental Science" will furnish gas enough for the purpose.

(9416) E. P. W. writes: I wish to ascertain the proper place to put an air-chamber in connection with an elevator, to prevent a ram which is caused by a sudden close of the elevator valve. How large should the chamber be according to the supply? Elevator men say the horizontal check valve is the cause of the ram. Is it? I make this inquiry as I am a water-meter man and we have a great deal of trouble with our meters on elevators on account of the ram. A. We apprehend that your troubles from water ram arise from a deficient supply of air in the air chamber. It is well known that water under great pressure absorbs the air in an air chamber, and besides a chamber full of air with no pressure will be compressed to less than 1-9 of the capacity of the chamber, so that your 8-inch pipe under 130 pounds pressure will have less than 7 inches of its length filled with air, which is not enough to take up the water ram. We advise to tap a small pipe into the air chamber at the bottom and connect a high-pressure air pump to fill the chamber with air at the water pressure. This will give enough elasticity to prevent water ram. The location is correct and no other change is needed.

(9417) J. W. L. says: In looking over a copy of "First Lessons in Physical Science" I found the following (on heat): "The difference in the sensation of warmth and vision produced by the ether waves does not depend upon any difference in the waves, but upon the difference of the bodies upon which the waves fall." Is this the correct theory of the relation of heat to light? A. A small portion only of the waves which come to the earth from the sun are able to affect the optic nerve and produce light. A much larger portion of the waves are too long to produce light in man and many of these will be felt as heat, if they strike a portion of our bodies which is provided with nerves for perceiving the sensation which we call warmth. There is no difference between these waves other than that of wave length. The term radiation is employed to denote the sending out of waves through the ether of space in this manner. The statement you quote is in agreement with the best modern statements on this point.

(9418) J. S. F. asks: Will you please tell me if there is a cheap and practical way of testing electric lamps, to tell whether they are up to the standard claimed for them? A. The proper mode of testing electric lamps is by the use of a voltmeter and ammeter or by a wattmeter. You can then determine whether the proper amount of current is consumed by the lamp. There is no simple method of measuring candle power which you can use, since the lamps do not give the same candle power in different directions. The rated candle power is a mean or average of all the light sent out in all directions. If the bulb has become dark with age on the inside, it should be replaced by a new lamp.

(9419) W. R. writes: Would you kindly inform me through your paper how I may be able to obtain the gray color on a leveling instrument? A. The steel-gray finish on brass instruments is obtained by refinishing. First clean off the old lacquer with alcohol, repolish all the surfaces to an even luster or dead finish and make every part clean from grease or finger marks. Then immerse in a solution of one ounce of arsenic chloride to one pint of water or in proportion for larger quantities, until the desired color is obtained. Wash in clear warm water, dry in sawdust, warm and relacquer with a thin and pale solution of bleached shellac in methyl alcohol. Use a broad camel's-hair brush.

NEW BOOKS, ETC.

DIE VERWERTUNG DES SPIRITUS FUER TECHNISCHE ZWECKE. Von Prof. Dr. N. Wender. Mit 88 Abbildungen. Vienna and Leipsic: A. Hartleben. Large 8vo. Price, $1.50.

Low-grade alcohol is destined to become of great industrial value as an engine fuel. Up to the present time, there has been no work in German in which the technical utilization of alcohol has been discussed with anything like the thoroughness technologists demand. The present book seems well calculated to supply this want. After treating of the method of utilizing alcohol in various countries, the author describes methods of producing alcohol, alcohol illumination, alcohol cooking and heating apparatus, alcohol motors and automobiles. In a brief chapter the author reviews the utilization of alcohol in chemical industry.

A TREATISE ON THE PRINCIPLES AND PRACTICE OF DOCK ENGINEERING. By Bryson Cunningham, B.E. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 559; 34 folding plates and 468 illustrations in the text. Price, $9.

From a practical point of view, this is a work that can hardly be too highly commended. It has also a certain historical value that should increase with years. No one can fail to appreciate the high importance of the subject in its relation to commerce, and hence in its relation to municipal and national prosperity. We have not space to review the volume in the manner it deserves, but, to give some idea of the contents, we may say that the practical side of dock engineering is dealt with under the following headings: Dock Design; Constructive Appliances; Materials; Dock and Quay Walls; Entrances, Passages, and Locks; Jetties, Wharfs, and Piers; Dock Gates and Caissons; Transit Sheds and Warehouses; Dock Bridges; Graving and Repairing Docks; and Working Equipment of Docks. The diagrams and illustrations are admirable; plans of many of the principal docks of the world are given, and a design for a model dock system is offered. The book should be in the working library of all who are interested in any phase of harbor improvement, or in the machinery and appliances used in such improvement.

A STUDENT'S MANUAL OF A SERIES OF QUANTITATIVE EXPERIMENTS. By Dayton Clarence Miller, D.Sc. Boston: Ginn & Co., 1903. 8vo.; pp. 404. Price, $2.

This textbook of physics is based upon the course given to the sophomore class in the Case School of Applied Science. The selection of the problems and their treatment is the result of twelve years' teaching experience, and the grade of work is that of the course in general physics which is taught in colleges and technical schools. The several important exercises are here printed for the first time in a laboratory manual; and among others that are given a more efficient treatment than is usual in such

books, are those concerning the comparison and calibration of graduated scales, the balance, density by hydrostatic weighing, thermometry, calibration of thermometers and high temperature measurements, the mechanical equivalent of heat, photometry, spectrometry, the capillary electrometer, and the like. The book is illustrated by 180 diagrams. It is concise in style, and will be found of great assistance in the teaching of physics.

STEVENSON'S SEA GUIDE AND YACHTING MANUAL FOR 1904. Edited by Paul Eve Stevenson. Published by Gardner & Cox, New York. 16mo.; pp. 219. Price, 25 cents.

An excellent manual for its purpose. It contains everything that a practical yachtsman needs to know, and a large amount of very useful information besides. The tide tables are complete, and, of course, thoroughly up-to-date. The information relative to waterways, anchorages, lighthouses, currents, and the various items that are essential to summer cruising is particularly detailed and complete. The manual has the advantage of being a size that can be slipped into the pocket, instead of being left to be stowed away in some locker, where it would be most inaccessible when it was most needed.

BUILDERS' ARCHITECTURAL DRAWING SELF-TAUGHT. By Fred. T. Hodgson. Chicago: Frederick J. Drake & Co., 1904. 8vo.; pp. 262. Price, $2.

Mr. Hodgson, in writing this book, has compiled from the various voluminous works on the subject, and from his own knowledge of architecture and building, a very helpful handbook for young men engaged in subordinate positions in these trades, who have no particular knowledge of drawing or geometry, but who, if they should acquire a fair working knowledge of these subjects, would be capable of filling, with credit, better positions. The book is written in concise style, and is well illustrated with some 250 odd drawings. It should be found very helpful by all who are trying to secure a working knowledge of architectural drawing.

CATALOGUE OF THE NATIONAL FIREPROOFING COMPANY. By Henry L. Hinton, Engineer. New York: The National Fireproofing Company, 1903. 12mo.; pp. about 250. Price, $3.

This handbook forms an abridged edition of the larger work to be brought out by the National Fireproofing Company, and which, it is expected, will deal very completely with fireproofing materials and construction. The present volume is printed from plates that will be used in the larger one, and is issued in the form of a pocket manual, being neatly bound in flexible leather covers. The sample pages it contains are taken mainly from the second and third divisions of the larger work, which treat of "material" and "safe loads." There are also, however, a number of pages of specifications of floor construction, entitled "Model Floors," and a series of "moment of resistance" tables, which make the handbook quite complete, since, aside from their special uses, they can also be used for obtaining the safe loads of the beams, and consequently can be made to take the place of the tables in the rolling mill catalogues, which tables have heretofore generally been used for obtaining the safe loads for the different sections of steel I-beams and channels. The book has numerous blank memorandum pages; and as it is the first concerted effort from a scientific standpoint which has been made to thoroughly treat of the materials now in common use, as well as the methods prevailing, in the construction of fireproof buildings, it should be of great use to all those engaged in the building trades.

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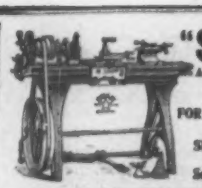

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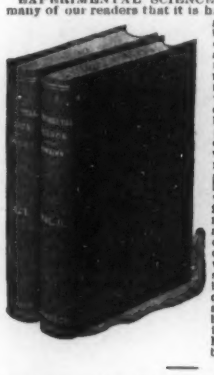

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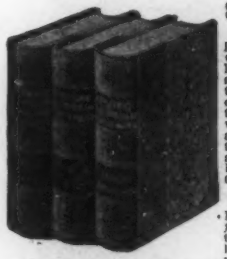

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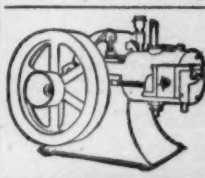

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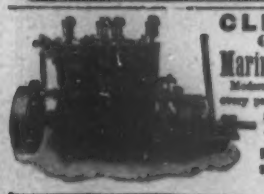

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